Meeting of the Central Valley Flood Protection Board
June 25, 2010

Staff Report

West Sacramento Area Flood Control Agency (WSAFCA)
The Rivers
Permit No. 18313-2

1.0 - BOARD ACTION

Consider sending a letter to the Army Corps of Engineers requesting 33 U.S.C. Section 408 approval to alter approximately 0.57 linear-miles of Federal Flood Control Project levee along the right (south) bank of the Sacramento River in Yolo County.

2.0 - APPLICANT

West Sacramento Area Flood Control Agency (WSAFCA)

3.0 - LOCATION

The proposed project is located in West Sacramento along the right (south) bank of the Sacramento River approximately 1.5 miles upstream from the American River outfall along the Riverbank Road, in Yolo County (see Attachment C). This reach of the levee is maintained by Maintenance Area (MA) 4.

4.0 - DESCRIPTION

This project includes work to modify approximately 0.57 linear-miles of levee on the crest of River Crest Drive Levee (STA 68+41 to 102+00) along the south bank of the Sacramento River; installing seepage cutoff wall from STA 70+77.73 to 101+24.07, ranging in depth from 90 to 125-feet deep; re-grade the landside slope to a 3:1 from STA 70+50 to 101+00; install six 4 inch diameter piezometers to a depth ranging from 23 feet to 54 feet; provide recreation features such as 262 feet of maintenance road, paved ramps, ADA parking, 3,936 feet of paved trails and bicycle/ pedestrian gates at levee station 100+25.

5.0 – PROJECT ANALYSIS

5.1 - Project Background

The West Sacramento Basin is bounded by the Sacramento bypass on the north, the Sacramento River on the east, the Yolo Bypass and Sacramento Deep Water Ship Channel (DWSC) on the west and the South Cross Levee on the south. The West Sacramento Basin is divided into the north and south basins. The levee system that protects these basins is a part of the Sacramento River Flood Control Project (SRFCP) and includes over 50 miles of levees in Reclamation District (RD) 900, RD 537, Maintenance Area 4, and DWSC. Its primary purpose is to prevent Sacramento River and Yolo Bypass flood flows from entering the City. The Rivers site is part of the Sacramento River North West Levee and is referred to as "The Rivers" EIP site.

The West Sacramento flood protection system was originally constructed by the U.S. Army Corps of Engineers as a part of the Sacramento River Flood Control Project. The non-federal sponsor of the flood control system is the Central Valley Flood Protection Board (CVFPB); however, the project is maintained and operated by the California Department of Water Resources (DWR), RD 900 and RD 537.

The West Sacramento Area Flood Control Agency (WSAFCA) AND THE City of West Sacramento City Council defined a policy of achieving a minimum 200-year flood protection for the City by adopting Ordinance 07-11at a City Council Meeting on May 2, 2007. The City of West Sacramento, through a team of consultants lead by HDR Engineering, has evaluated the levee system and found it to be inadequate for protecting the City from a 200-year flood event.

The City's overall levee improvement program includes identification of candidate sites for the State Flood Control System Program, Early Implementation Projects (EIP). These are projects that are to be built in advance of publication of the State Plan of Flood Control scheduled for 2012. EIP sites are assumed to conform to the eventual requirements defined by the State Plan of Flood Control. The Rivers EIP site was identified for improvement as part of the EIP program.

Land use in the proposed project area is primarily residential with a school and parks nearby. There is also a large riparian strip of land adjacent to the Sacramento River. The impacts to private landowners will be compensated, and public lands will be used where possible for outfall location, and valuable riparian habitat will be avoided as well.

Maintenance Area (MA) 4 has endorsed this project and construction has been initiated on one other phase of the WSAFCA to the south of the proposed project. This project and the CHP Police Academy Levee along the south bank of the Sacramento Bypass is the next phase of improvements scheduled for the WSAFCA. The most recent project to be approved and constructed was permit number 18336. This initial Early Implementation Project was to construct a 600 foot long seepage

cutoff wall on the right (west) bank of the Sacramento River south of the “I” Street Bridge.

5.2- Project Design Review

Flood System Improvements Section staff completed a technical review of the following documents:

- 90% Plans and Specifications for the Rivers Site, Station 71+00 to 101+00.
- Design Documentation Report, 90% Design Submittal for the Rivers Site.
- Technical Specifications, 90% Design Submittal for the Rivers Site.
- Geotechnical Analysis Summary, The Rivers Site Station 70+00 to 115+00 – Kleinfelder (September 9, 2009) Volumes 1 and 2.
- Hydrology / Hydraulic Analysis – MBK Engineers

This technical review concluded that the designs for the Rivers Site are in accordance with Board, USACE standards, and DWR Interim Levee Design Criteria.

5.3 – Hydraulic Analysis

Changes were made to the hydrology and hydraulic model from the March 2007 report and the effects of these changes on the computed 200-year design and the 100-year FEMA criteria water surface elevations in the waterways surrounding West Sacramento made improvements to the perimeter levee system around the City.

The hydraulic design performed by MBK Engineers modeled the design water surface elevation (WSE) based on the following criteria:

- A 200-year (1/200 Annual Exceedence Probability (AEP)) flood event,
- Levees overtop without failure,
- Folsom Joint Federal Project (JFP) in place (200-year peak Folsom Dam release of 160,000 cfs),
- The following components of the Three Rivers Levee Improvement Project is in place:
    - RD 784 Bear River levee setback (which it is),
    - RD 784 Western Pacific Interceptor Canal levee raise (which it is),
- Sacramento River Flood Control Project (SRFCP) levees with deficient design freeboard were raised to eliminate the deficiency.

The FEMA criteria water surface profiles presented in the 2007 report were based on the following criteria:

- A 100-year (1/100 AEP) flood event,

- Levees overtop without failing,
- Current Folsom Dam and operation (100-year peak Folsom Dam release of 145,000 cfs).

Refinements, modifications and updates to the hydraulic model and hydrology have resulted in revised water surface elevations. The changes and the resulting revised water surface elevations are incorporated in this staff report.

The proposed design provides a minimum of 3-feet of freeboard above the 200-year design storm plus an additional height for post-construction settlement. This designed levee should not have significant issues with erosion and scour due to the location of the existing levee, which will be relocated a maximum of twenty-five feet water ward and still posses 340 feet to 440 feet of slope to the normal water edge along a 10:1 slope (flat).

Station	200Yr. WSE	Ex.Grade	Finished Grade	Freeboard
71+00	36.67 feet	41.50 feet	41.32 feet	**4.65 feet**
101+00	36.68 feet	42.10 feet	42.03 feet	**5.35 feet**

The wind setup and wave run-up should be negligible for this reach of the Sacramento River which flows west to east and in the same direction of the wind waves. The fetch distance is relatively small across this portion of the river with the wind /wave run-up reduced to non-existent with existing riparian vegetation in place.

Storm-water runoff from the waterside of the levee and the landside of the existing levee will be collected in drainage swales. Flows from swales, trails and maintenance roads will be accumulated and safely conveyed to rock rip-rap outfalls into the Sacramento River. The drainage system is designed for a 10-year storm event; however, the system can handle a larger storm event without failing the levee.

The West Sacramento engineering consultant performed hydraulic simulations to estimate effects of future mean sea level change on the design. From their report dated February 09, 2009, that rate of rise in water surface elevation varies from 0.01 feet to 0.08 feet. This is less than significant.

Staff reviewed the hydraulics analysis and agreed with the hydraulic report's conclusion that the project will not have adverse hydraulics impact to the Sacramento River Flood Control System. No major project feature of the project encroaches into the channel and overbank of the Sacramento River.

5.4 – Geotechnical Analysis

This geotechnical review has been made based upon the documentations provided by WSAFCA for the improvement of the Rivers Site (from STA 71+00+00 to STA

101+00) along the Sacramento River, Yolo County, California. In particular, the review is based on the data presented in the geotechnical data and Design Document Report, and partially on the Technical Memorandum Analysis Summary and Recommendations.

The proposed levee re-configuration varies in re-compacted height from 10 to 15 feet. Top widths are 20 feet wide at the crest with 12 feet of 3 inch A.C. on 9 inches of AB. Landside slopes are designed to be 3:1 and waterside slopes vary from 3:1 to ~10:1. The soil cement bentonite (SCB) cut-off wall will be positioned along the centerline of the reconstructed levee and consist of a clay cap and 95 percent compacted soil benched and keyed into the existing levee.

Models for analysis of the Rivers Site levee were selected at station 87+50, 97+50 and 114+00. The model cross sections were developed at each location using available topographic data provided by HDR Engineering. The stratigraphy and soil property parameters for the models were selected using available subsurface data gathered from the exploration locations and presented in the Technical Memorandum provided by West Sacramento and dated September 9, 2009. The subsurface data includes borings and cone penetration tests (CPTs) performed by URS in 2006, CPTs performed by DWR in 2006 and 2007, and borings and CPTs performed by Klienfelder in 1988,1989, 1992, 2007, and 2009.

The design water surface elevation (WSE) values (1957, 100-year, 200-year, and 200-year + 3 feet) are based on the information provided in the report entitled "Supplemental Report for the City of West Sacramento Levee Alternatives Hydraulic Analysis (Draft)," by MBK Engineers (MBK), dated august 6, 2008.

5.4.1 - Kleinfelder modeled three site areas which are representative of the total site as follows:

Model Sta.	Represented Sta.	Discussion
87+50	71+50 - 92+50	The levee was originally widened by the addition of sandy fill material abutting the original silt/clay levee embankment.
97+50	92+00 - 98+00	This section of the levee has reportedly experienced seepage and boils at the toe during previous high river stage events. This is silt with a clay layer on the water side and sandy soils beneath the landside toe. In the subsurface there are layers of silty and sandy soils with strata's of underlying clays.
114+00	98+00 - 115+00	This section of the reach has been widened on the water side by the addition of sandy fill materials and recently placed compacted fill materials (composed of silty sands) placed during grading and construction of the former Lighthouse Marina (now Rivers) residential community.

Based on the general subsurface conditions, cross sections at stations 87+50, 97+50, and 114+00 were analyzed for seepage and slope stability as provided in the Rivers Site Technical Memorandum by DWR and Klienfelder.

The geotechnical analyses conducted were seepage analysis, slope stability analysis, settlement analysis, seismic analysis, and cutoff wall trench stability analysis during construction. The seepage and slope stability analyses were conducted based on both USACE and DWR Interim Levee Design (ILDC - 2009) criteria. A deterministic 200-year water surface elevation by MBK Engineers, were used in the models. The analyses were generally in agreement with the standard of practice in the Sacramento area, and as per required regulatory guidelines.

5.4.2 - Seepage Analysis

Allowable Gradient COE= </= 0.5 DWR-ILDC= </= 0.6

Planned Station	Exit Gradient Existing Condition	Proposed Condition	SCB Cutoff-Wall Depth
87+50	1.47	0.13	125 feet
97+50	1.00	<0.13	95 feet
114+00	1.72	0.18	85 feet

The results of the analysis for the 200-year +3 feet WSE indicate a cutoff wall should be effective in lowering the exit gradient to an acceptable value.

5.4.3 - Waterside Stability Analysis

Allowable Factor of Safety COE= 1.2 to 1.4 DWR-ILDC= 1.3 to 1.4

Planned Station	Factor of Safety	Existing Condition	Proposed Condition
87+50		2.50	2.50
97+50		1.09	1.84
114+00		0.90	1.48

At Station 87+50, a significant amount of material is present against the waterside of the levee and the analysis was performed at the riverbank, which met the required Factor of Safety. At Station 97+50, the over steepened slope will be reconstructed from a 1.5:1 slope to a 3:1 slope. At Station 114+00 is buttressed by a 200-foot wide

engineered fill pad. Therefore, the proposed levee stability meets the allowable factor of safety.

5.4.4 - Seismic Evaluation

Klienfelder performed seismic evaluation of three likely scenarios for the Rivers Site of the Sacramento River West North Levee as follows:

Case A: Potential Flow Liquefaction or Large Deformations. This case indicates that the Factor of Safety against liquefaction is less than 1.0 which is acceptable. In addition the Factor of Safety against post-earthquake static slope stability is also less than 1.0 and/ or the yield acceleration (Ky) is less than or equal to 0.15 PGA (peak ground acceleration) for a pseudo-static slope stability which is also acceptable.

Case B: Liquefaction Induced Deformation. This case indicates that the Factor of Safety is less than 1.0 which is acceptable. However, the potential for limited liquefaction induced deformation does exist.

Case C: Limited Settlements. Deformation due to earthquake-induced settlement in dry soils or soil strength softening is possible.

Current design recommendations by Klienfelder have not taken into consideration, future changes to the existing topography and/ or land uses. Should future excavation or addition of material to the levee occur, a new analysis will need to be run.

5.4.5 - Monitoring Wells

There are six monitoring wells proposed. Three are to be located at Sta. 87+50 and three are proposed at Sta. 97+50. Each series of the wells will be located at the Landside toe, the levee crest on the waterside of the cutoff wall and the levee crest on the Landside of the cutoff wall. Installation of wells on the crest to both waterside and landside of the cutoff wall will allow for measurement of water level on each side of the cutoff wall and assess efficiency of the cutoff wall. Well depths vary from 23.5 feet deep to 52 feet deep.

5.4.6 - DWR Maintenance Yard Groundwater Contamination

Environmental contamination as a result of a leaking underground fuel storage tank has occurred within the upstream extent of the project adjacent to the DWR Maintenance Yard at the west end of the proposed project. DWR is the lead agency investigating the contamination and has performed field investigations in an attempt to map the contamination boundaries.

5.4.7 - Existing Features

This project has several existing features, located at the site, which may interfere with the proposed improvement project, and are as follows:

- Existing utilities
- Fences
- Close proximity to Electrical Power Poles
- Close proximity to city streets and residential streets
- residential housing

Some of the above features will dictate design modification during construction, however, all utilities found within the proposed levee prism will be removed or relocated. Care will be taken to protect existing features in place and away from the levee prism.

5.5 - Project Benefits

This project will have the following benefits:

- Addresses major geotechnical concerns such as through and under-seepage, excessive hydraulic gradients, bank erosion, scour, and unacceptable encroachments
- Strengthens and improves the levee to provide increased stability
- Provides 200-year water surface elevation (WSE) + 3-feet hydraulic protection
- Provides monitoring capabilities for the proposed cutoff wall.
- Provides recreational features such as trails, river outlooks, pedestrian and ADA access ramp and vehicle parking.
- Safeguards against surface storm water runoff.

5.6 - Project Specific Issues and Mitigations

Below is a table of project specific concerns and the design mitigation measures that WSAFCA has proposed.

Concern	***Mitigation***
Through-seepage	Widened levee throughout the project
Under-seepage monitoring	Combination of cutoff walls, and piezometers
Excessive hydraulic gradients	Seepage analysis indicate that the proposed SCB cutoff wall reduces the exit gradient to acceptable levels throughout the project
Bank erosion / scour	Existing wave buffer slopes with vegetation and a low flow stability shelf throughout the project with existing riprap
Waterside encroachments	widen levee throughout the project with K-rails, vegetative fencing, paved trails and flat slopes help support the waterside slope.

The above concerns and mitigations are incorporated into the approved drawings and Board staff has reviewed the above proposed design and the design is in compliance with standards.

5.7 - Project Issues from 408 Request

1- Landside toe patrol road conflict with existing adjacent curb and gutter, Riverbank Road, Fountain Drive and electric overhead power poles. The designers have pushed the levee water ward.

2- The initial design extended the project to the east where there were existing houses on the water side of the levee. That reach has been removed from the 90% plan set.

3- This project had initial comments from Board staff, based on the 60% plans, reports, and specifications. These issues have been resolved, in the materials that were reviewed, and the project is designed in accordance with Board, USACE, and DWR ILDC Standards. For example:
   a. The west end project proposes a landside ramp which meant that the levee had to be shifted towards the water. This was done.
   b. There were areas along the landside toe that needed to be shifted waterward to keep a 15 foot patrol road from the property line.

5.8 - Landrights

The City of West Sacramento is currently working with landowners affected by this project scope and required easements are forth coming. The following tabulation categorizes the various parcels (see attachments F,G & H):

APN	Location	Discussion
014-580-010	Largest parcel on west end.	Privately owned, no structures
014-580-009	2nd largest parcel, middle.	Same owner as above, however there are utilities to this parcel.
014-760-001& 014-690-072	Waterfront corridor. "	Owned by the State & The Rivers Development. Easements shouldn't be a problem.
014-690-087	most easterly lot.	This is the first residential bldg. adjacent to the end of the project.
014-690-088 to 014-690-091	series of lots impacted by this project.	Various private ownership & the Rivers Development. The lots have new utilities stubbed off to the parcels.
014-720-002 & 014-720-057, 014-720-064, 014-720-065, 014-690-044, 014-690-045.	Lots are of the landside toe of the new levee.	Existing landside plantings will Be removed during construction. Existing fencing will be at least 15' off the toe.

5.9 – MA-4 Special Conditions

The conditions outlined below, will be attached to the proposed Permit No. 18313-2 as Exhibit B.

1) Maintenance of all encroaching structures, facilities, vegetation or any other items or matters approved under this permit shall remain the responsibility of the Permittee unless otherwise agreed to by the Maintenance Area

2) The initial soils explorations were found to be lacking in depth enough to identify the soil layers in the cutoff wall termination points for the majority of the reach. In June 2010, 12 CPTs (depths of 115 to 145 feet) and 3 sonic borings were performed, evaluated and integrated into the project design.

3) The typical cutoff wall clay cap shown on the 90 percent drawings is not constructible as shown with sloping compacted lifts. The City will revise those lifts to be horizontal with benching into native material.

4) The project proposes the top of levee to be surfaced with 3 inches of asphaltic concrete on 9 inches of aggregate base material. The DWR Flood Maintenance Office (the LMA) is concerned that they would have to maintain asphalt cracks. It will be written into the permit that the City of West Sacramento will be responsible for the maintenance of the paved roadway.

5) The Permittee shall obtain all necessary permits and regulatory approvals for the proposed work.

6) Work on the levee or within the Sacramento River shall be done outside of the flood season (November 1 to April 15) unless otherwise approved by the Central Valley Flood Protection Board and the Maintenance Area.

7) Permittee shall acquire necessary right of way for the improvements and convey said rights to the District for operation and maintenance of the flood control features to the satisfaction of the Maintenance Area.

8) Permittee shall restore the levee, access roads, gates, fences and other associated flood control facilities to the satisfaction of the District upon completion of the work.

9) Permittee shall restore levee and access to the satisfaction of the Maintenance Area prior to flood season unless otherwise approved by the District.

10) In event of an emergency, Permittee shall immediately restore the levee and access to the satisfaction of the Maintenance Area.

6.0 - STAFF RECOMMENDATION

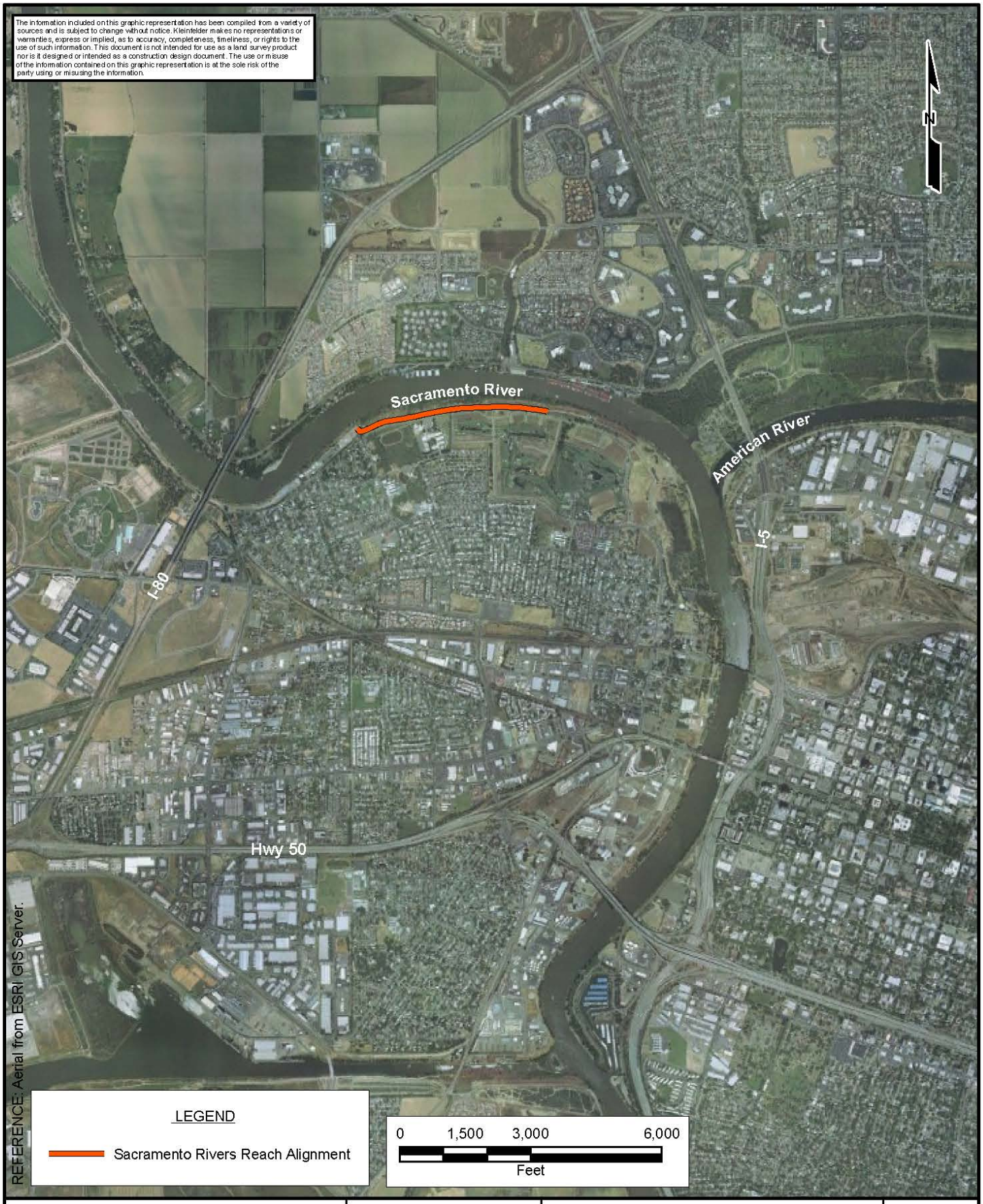
Staff recommends that the Board approves sending the attached draft letter to the U.S. Army Corps of Engineers requesting 33 U.S.C. Section 408 approval (Attachment B) to alter approximately 0.57 linear-miles of Federal Flood Control Project levee along the right (south) bank of the Sacramento River as proposed in Application No. 18313-2 by WSAFCA of Yolo County.

7.0 - LIST OF ATTACHMENTS

A. Location Map
B. Draft 408 Request letter to the C.O.E.
   Exhibit A: Corps 408 Letter, to be received prior to 6-25-2010 Meeting
C. Project Summary Report
D. Project Features Table
E. Typical Sections

F. Assessor's Parcel Map 14-69
G. Real Estate Impact
H. Landownership; Table-2

Prepared by:	David R. Williams, P.E.
Design Review by:	David R. Williams, P.E.
Geotechnical Review by:	David R. Williams, P.E.
Hydraulic Review by:	David R. Williams, P.E.
Final Reviews by:	Dan Fua, P.E. Len Marino, P.E.



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PROJECT NO.	101153-riv
DRAWN:	6/22/09
DRAWN BY:	D. Anderson
CHECKED BY:	B. Anderson
FILE NAME:	101153 BOD Riv SLM.mxd

SITE LOCATION MAP

DRAFT GEOTECHNICAL BASIS OF DESIGN REPORT
THE RIVERS SITE, SRWNL STA 70+00 TO STA 115+00
WEST SACRAMENTO LEVEE IMPROVEMENT PROGRAM
WEST SACRAMENTO, CALIFORNIA

PLATE
1-1

STATE OF CALIFORNIA – THE RESOURCES AGENCY **ARNOLD SCHWARZENEGGER,** GOVERNOR

CENTRAL VALLEY FLOOD PROTECTION BOARD
3310 El Camino Ave., Rm. 151
SACRAMENTO, CA 95821
(916) 574-0609 FAX: (916) 574-0682
PERMITS: (916) 574-0685 FAX: (916) 574-0682

July 23, 2010

Colonel Thomas C. Chapman, District Engineer
U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, California 95814

Dear Colonel Chapman:

Based on the Policy and Procedural Guidance for the Approval of Modification and Alteration of Corps of Engineers Projects dated October 23, 2006, and on behalf of West Sacramento Area Flood Control Agency (WSAFCA), the Central Valley Flood Protection Board (Board) is requesting permission from the U.S. Army Corps of Engineers (Corps) to alter of a portion of the Sacramento River Flood Control Project (SRFCP). The Board is making this request pursuant to 33 U.S.C. Section 408.

The Board has reviewed the project plans and drawings, the geotechnical report, hydraulic analysis, and other reports submitted by WSAFCA for the construction of 0.57 linear-miles of modified Federal Flood Control Project levee along the right (south) bank of the Sacramento River in Yolo County. The Board has determined that WSAFCA will accomplish this alteration in a manner that will not be injurious to the public interest and will not impair the usefulness of the SRFCP. Attached is the information you required to accompany this request as outlined in your October 23, 2006 policy and procedural guidance.

If the proposed project, upon completion, is formally incorporated within the federal SRFCP by the Corps, the State of California, acting through the Board, will accept the altered project for operation and maintenance and hold and save the United States free from damage due to the constructed works.

Within 180 days of completion of the project alteration, the Board will provide both information to the Corps for the purposes of preparing a revised Operation and Maintenance Manual for this portion of the SRFCP, and as-built Plans and Specifications for the alteration.

In order to achieve the flood control benefits of this work for the 2010-2011 flood season, the Board is requesting that the Corps make any necessary

determination so that WSAFCA may proceed with this alteration by January 2011.

If you have any questions, please feel free to contact me at (916) 574-0609, or your staff may contact Dan S. Fua, Staff Engineer of the Board, at (916) 574-0698.

Sincerely,

_____

Benjamin F. Carter, President
The Reclamation Board

Approved as to Legal Form and Sufficiency:

_____

Scott Morgan, Legal Counsel

_____

Maureen “Lady Bug” Doherty, Secretary
The Reclamation Board

Attachments

cc: Mr. Kenneth A. Ruzich, General Manager
West Sacramento Area Flood Control Agency
1110 West Capitol Avenue, Second Floor
West Sacramento, California 95691

Mr. Michael Bassett, City of West Sacramento
West Sacramento Area Flood Control Agency
1110 West Capitol Avenue, Second Floor
West Sacramento, California 95691

Ms Claire Marie Turner, Project Manager
USACE, Sacramento District
1325 J Street – 14th Floor
Sacramento, California 95814

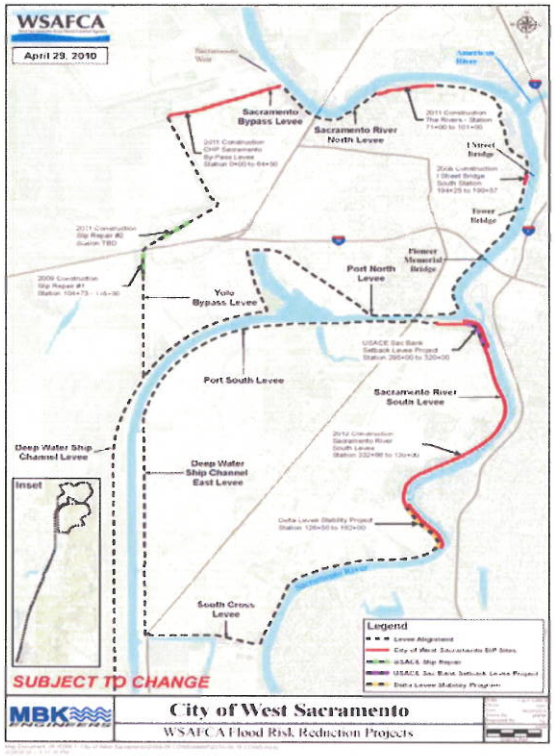
West Sacramento Levee Improvement Program

The Rivers Project and

The CHP Academy Project

Project Summary Report

Section 408 Application



Prepared for:
West Sacramento Area Flood Control Agency
1110 West Capitol Avenue,
West Sacramento, CA 95691

U.S. Army Corps of Engineers
1325 J Street
Sacramento, CA 95814

Prepared by:
MBK Engineers
1771 Tribute Road, Suite A
Sacramento, CA 95815

ICF Jones & Stokes
630 K Street
Sacramento, CA 95814

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West Sacramento Levee Improvement Program

The CHP Academy and the Rivers Projects

Section 408 Project Summary Report

1 Program Overview

The West Sacramento Area Flood Control Agency (WSAFCA) is in the process of designing and constructing improvements to the levee system that protects the City of West Sacramento (City) in California (**Plate 1**). Early improvements are part of the West Sacramento Levee Improvement Program (WSLIP). The goal of the WSLIP is to achieve a minimum level of 200-year flood protection for the City.

The City's comprehensive flood control strategy has been guided by the following objectives adopted by the WSAFCA in connection with the WSLIP: 1) provide at least a 200-year level of flood protection to the City, 2) complete urgent levee improvements in advance of construction by the U.S. Army Corps of Engineers (USACE) with funding assistance from the California Department of Water Resources (DWR), 3) partner with the USACE and DWR to coordinate efforts on the development of technical documents and of a General Re-evaluation Report (GRR), and 4) identify opportunities to work with local and regional partners to complete work efficiently and to supplement local funding.

The WSLIP seeks to meet all of the USACE's current levee design criteria. Early implementation projects constructed in advance of USACE construction will be improved to at least a 200-year level of protection. The remaining reaches of the levee system protecting the City will be improved to meet applicable standards for the 200-year water surface elevation from 2010 to 2016. This work will be carried out by the USACE following completion of a GRR and Congressional approval for expanding the scope of the West Sacramento Project. It is anticipated that the GRR will be completed in 2013.

2 Physical and Functional Description of the Existing Project

The regional setting of the WSLIP is the Sacramento River Flood Control Project (SRFCP), beginning as far north as Redding, California, and extending south to the Sacramento–San Joaquin River Delta (Delta). For the analysis of effects (direct, indirect, or cumulative), the regional context of the SRFCP is taken into consideration.

The WSLIP study area refers to the area that would be protected by the proposed levee improvements, including the city of West Sacramento itself and the lands within WSAFCA's boundaries, which encompass portions of the Sacramento River, the Yolo Bypass, the Sacramento Bypass, and the Sacramento Deep Water Ship Channel (DWSC). The flood protection system associated with these waterways consists of over 50 miles of levees in RD 900, RD 537, DWR's Maintenance Area 4, and the DWSC. These levees completely surround the city with the exception of intersecting waterways. For the purposes of this program, the levees surrounding the city have been divided into nine sub-reaches.

The city of West Sacramento is located in eastern Yolo County at the confluence of the American and Sacramento Rivers. The city lies within the natural floodplain of the Sacramento River, which bounds the city along the east. It is made up of reclaimed land protected from floods by levees and the Yolo and Sacramento Bypass systems. These bypasses divert flood-flows around the city to the west. In addition to the area within the city limits (in Yolo County), the study area partially extends into Solano County on the extreme southwestern edge along the DWSC. Therefore, resources in Solano County have the potential to be affected by the WSLIP and these effects are described on a resource specific basis.

The DWSC and barge canal bisect the city into two sub-basins, separating the developing Southport area from the more established neighborhoods of Broderick and Bryte to the north (City of West Sacramento 2000). The DWSC provides a navigable passageway for commercial shipping to reach the Port of West Sacramento (formerly Port of Sacramento) from the Pacific Ocean via the San Francisco Bay, Delta, and connecting waterways.

The area that would be protected by the WSLIP—the city of West Sacramento—is the downstream most metropolitan area within the SRFCP, along with the city of Sacramento across the Sacramento River on the left bank. The downstream location of the study area is important relative to other flood risk reduction projects occurring upstream within the SRFCP, namely, the American River Common Features Project, Natomas Levee Improvement Program, projects undertaken by the Three Rivers Levee Improvement Authority, the Sutter Basin Project, and the Yuba Basin Project.

The City, along with the two districts providing operation and maintenance of the existing levee, Reclamation District (RD) 900 and RD 537 have actively pursued the goal of providing reliable flood protection for the West Sacramento area. Working through WSAFCA and in coordination with the USACE, the Central Valley Flood Protection Board

(CVFPB), and DWR, two major flood control projects have been completed. The first was constructed from 1990 through 1993 as part of the Sacramento Urban Levee Reconstruction Project. The second project was the West Sacramento Project constructed between 1998 and 2002.

However, even as design work was nearing completion on the West Sacramento Project, underseepage was noted along the Sacramento Bypass levee in 1997; and stability issues became apparent in 1998 along the RD 537 levee. The City and RD 900 requested the USACE to conduct additional geotechnical investigations and incorporate design changes to address these issues. As a result, the completed West Sacramento Project was modified to reconstruct an entire section of RD 537 levee to replace the original clay and organic material with engineered fill, and place a 60 to 70 foot deep slurry wall to control underseepage along the segment where the Sacramento Bypass and Yolo Bypass levees intersect.

In the wake of the 1997 storms, the USACE identified underseepage as an area of concern. Only recently, however, has the USACE issued revised federal levee design criteria to provide a consistent approach for addressing potential levee underseepage. The geotechnical and engineering investigations currently being conducted for West Sacramento levees have utilized the revised federal levee design criteria. Current engineering analysis depicts the nature of levee deficiencies. WSAFCA's team of consultants is currently working to identify necessary improvements to provide a 200-year level of flood protection for the City.

3 Existing Condition of the Project Levees

3.1 Overview

The City is located along the shores of the Sacramento River within the central region of the Sacramento River Valley. It is located directly across the river from the City of Sacramento, the State's capital. The Sacramento River is the main drainage for the area and flows generally north to southeast from the Klamath Mountains to the San Francisco Bay Area. The West Sacramento basin is bounded by the Sacramento Bypass on the north, the Sacramento River on the east, the Yolo Bypass and the Sacramento Deep Water Ship Channel (DWSC) on the west, and the South Cross levee on the south (**Plate 1**). The levee system is a part of the Sacramento River Flood Control Project (SRFCP), and includes over 50 miles of levees in Reclamation District (RD) 900, RD 537, Maintenance Area 4, and DWSC.

A flood emergency preparedness mapping study prepared by Wood Rogers for the City found that for the 100-year event, the City acts as two distinct hydraulic basins. The City is bifurcated by the Port (**Plate 1**). A breach north of the Port is projected to only inundate the northern basin and a breach the south of the Port is projected to only inundate the southern basin. The study did not examine how the basins would respond if flooding occurred from a levee breach during the 200-year flood event. Preliminary investigations suggest that depending on the location of a levee breach and the duration of the flooding event the north and south basin may act like one basin during a 200-year flood event.

3.2 North Area Basin

The North Area, representing approximately six square miles, is bounded by the Port North Levee and the DWSC to the south, the Sacramento River West–North Levee to the north and east, the Sacramento Bypass Levee to the north, and the Yolo Bypass Levee to the west. Land in this area varies in elevation from El. 20.0 feet at the north boundary to El. 16.0 to 18.0 feet adjacent to the DWSC. The north bank of the DWSC is generally about El. 19.5 feet. This area is traversed by the right bank of the Sacramento River from RM 63.0 to RM 57.5.

Yolo Bypass Levee

The Yolo Bypass Levee extends for approximately 3.7 miles along the eastern levee of the Yolo Bypass extending from the intersection of the Sacramento Bypass and the Yolo Bypass until the intersection with DWSC West, also known as the Navigation Levee (**Plate 1**). An access road runs along the levee crown and is in adequate condition. The majority of the waterside slope is covered with riprap.

Sacramento Bypass Levee

The Sacramento Bypass Levee extends for approximately 1.13 miles along the southern levee of the Sacramento Bypass from the confluence of the Sacramento River and the Sacramento Bypass until the intersection of the Sacramento Bypass and the Yolo Bypass (**Plate 1**). A section of the waterside slope of the levee has a concrete covering to prevent erosion. There also exists an access road along the top of the levee which appears to be in adequate condition.

Sacramento River West-North Levee

Sacramento River West-North Levee extends for approximately 5.5 miles along the Sacramento River western levee from the Sacramento Bypass until the confluence of the Barge Canal. North Harbor Boulevard runs along the levee crown for a section of this reach. The road then drops off the levee and an access road continues until it dead-ends into a DWR facility (**Plate 1**). River Crest Drive travels along the levee crown inside of The Rivers residential development with houses on the widened levee crown. There are several other structures on the levee crown along the Sacramento River West North Levee as it extends into commercial and industrial areas. The levee also fades into and then out of a natural area of high ground known as the Triangle.

Port Levee North

Port Levee North extends for approximately 4.9 miles along the northern bank of the Port of Sacramento extending from the confluence of the Barge Canal and the Sacramento River until the intersection with the Yolo Bypass Levee (**Plate 1**). There are many structures along the levee for use at the Port of Sacramento. The levee appears to be more of a raised section of land within an industrial district rather than an actual levee. There are many access points due to the presence of the Port of Sacramento and the industrial district.

3.3 South Area Basin

The South Area incorporates approximately five square miles and varies from El. 18.0 feet to El. 8.0 feet. The area is bounded by the Port South Levee and the DWSC to the north, the Sacramento River West-South Levee to the east, the South Cross Levee to the south, and the DWSC East Levee to the west. The South bank of the DWSC from Lake Washington to the Sacramento River is generally at approximately El. 19.5 feet. The right bank of the Sacramento River extends from RM 57.7 to RM 51.5.

Sacramento River West-South Levee

Sacramento River West-South Levee extends approximately 5.9 miles along the Sacramento River western levee from the Barge Canal at the confluence of the Sacramento River to the South Cross Levee (**Plate 1**). South River Road runs along

the top of the Sacramento River West South Levee for the majority of this reach. The road diverts off of the levee top and runs along the landside toe for a short distance. The Sacramento Northern Railroad line runs on top of the levee along the stretch of levee where South River Road runs along the landside toe (this railroad line has been abandoned and the tracks have been removed). South River Road returns to the top of the levee at the southernmost tip of Sacramento River West South Levee and the railroad diverts to the landside toe. Several overhead power lines cross over the levee and run alongside the landside hinge point throughout Sacramento River West South Levee.

South Cross Levee

South Cross Levee extends for approximately 1.2 miles from Jefferson Boulevard to the Sacramento River where it connects with the southern end of the Sacramento River West South Levee (**Plate 1**). The slopes of this levee have vegetation and large trees growing sporadically throughout the reach. The levee crown is covered by a thin layer of aggregate base roughly 12 feet wide.

Deep Water Ship Channel East

Deep Water Ship Channel East extends for approximately 2.8 miles south along the eastern levee of the DWSC from the conclusion of the Port South Levee until the intersection of the South Cross Levee (**Plate 1**). The levee is comprised primarily of dredged material from the construction of the DWSC with a gravel access road long the levee crown. The access road in is need of repair and maintenance to improve accessibility.

Deep Water Ship Channel West

Deep Water Ship Channel West extends for approximately 21.4 miles south along the western levee, also known as the Navigation Levee, of the DWSC from approximately the mid-point of the bend in the DWSC to Miner Slough (**Plate 1**). The levee is comprised primarily of dredged material from the construction and subsequent cleaning of the DWSC with an access road along the levee crown. There appears to be an extensive supply of material which could be used as fill to repair and improve other sections of the levee system. Further investigation is required to determine the adequacy and quantity of the potential fill material.

Port South Levee

Port South Levee extends for approximately 4 miles from the confluence of the Sacramento River and the Barge Canal, west along the southern levee of the Port of Sacramento (**Plate 1**). The levee is comprised primarily of dredged material from the construction of the DWSC with a gravel access road along the levee crown. The access road is in need of repair and maintenance to improve accessibility.

4 Purpose and Need for the Modification

The purpose of the WSLIP is to achieve a minimum of 200 year flood protection for the entire city by improving the approximately 50 miles of levees protecting West Sacramento. A 200 year flood is a flood that has a 0.5% chance of occurring in any given year, or annual exceedance probability (AEP).

The approach to meet this purpose is to provide a comprehensive evaluation of the entire levee system that protects the city, develop recommended strategies for improvement, and provide a basis for partnerships with Federal and state agencies to implement improvements that meet the flood protection and compatible recreation and open space goals. The objectives under this purpose and approach are to:

- construct levee improvements as soon as possible to reduce flood risk as quickly as possible;
- construct improvements that are politically, socially, economically, and environmentally acceptable;
- provide recreation and open space elements for the city that are compatible with flood improvement actions; and
- ensure continuing Federal assistance for levee repairs and maintenance.

The levees protecting the City protect over 13,000 acres of mixed-use land in eastern Yolo County. It is estimated that this area has a current population of 47,000 residents. The Basin contains the Port of West Sacramento (Port), which supports major industrial and commercial functions. In addition to the Port, the Basin also contains three major public transportation facilities, Highway 50, Interstate 80, and State Route 84. A recent review of the economic analysis conducted for the Sacramento and San Joaquin River Basins Comprehensive Study indicates the depreciated replacement value of approximately $3.5 billion for the structures and contents potentially damaged by a flood in West Sacramento. In 2002, the Sacramento Area Council of Governments (SACOG) framed a discussion about long-range regional development scenarios. According to SACOG projections, West Sacramento will grow at a steady rate over the next 50 years, adding 20,000 residential units by 2030 and 33,000 by 2050. SACOG also forecasts growth in job opportunities by adding 30,000 new jobs by 2030 and 41,000 new by 2050. A failure of the perimeter levee system could cause very deep inundation of the Basins and cause a major loss of the property at risk. Segments of the levee system are not high enough to meet the State's 200-year flood protection requirements. Moreover, recent studies indicate the potential for underseepage, through-seepage and embankment instability in many locations, and several sites of substantial bank erosion exist along the Sacrament River West Levee.

Five needs have been identified for the WSLIP.

- Study results from the comprehensive levee evaluation have shown that the levees protecting the city need improvements to reduce the current level of risk to human health and safety, property, and the adverse economic effect that serious flooding would cause.
- Study results further have shown that the levees in WSAFCA's area are deficient when compared against current Federal standards. Action is needed to bring them up to current standards in order to maintain eligibility for Federal emergency management assistance. Those improvements are necessary to meet FEMA's minimum acceptable level of flood protection (commonly referred to as the 100-year flood) as specified by the National Flood Insurance Program (NFIP). (HDR, Inc. 2008.)
- As required by Senate Bill (SB) 5 (signed by Governor Schwarzenegger in October 2007), the Central Valley Flood Protection Board (CVFPB) must adopt a Central Valley Flood Protection Plan (CVFPP) by July 1, 2012. The CVFPP will require a 200-year level of flood protection for urban areas by the year 2025. Levee improvements are necessary to meet that requirement.
- As a growing community, the City has recreation and open space needs and goals that are unmet. Surrounding waterways represent not only an element of flood risk but also great opportunity for water-based recreation and public open space. Flood protection improvement elements typically underlie or are adjacent to proposed recreation elements that are part of the City's planning documents. There is a need to provide West Sacramento residents with recreation elements that are compatible with flood protection improvements.
- WSAFCA's area is the downstream-most metropolitan area in the SRFCP. As other projects have been implemented or improvements are being planned to reduce risk and increase flood protection for upstream communities, there is concern that the performance of the SRFCP needs to be evaluated comprehensively to ensure that the individual projects are kept in balance, that effects among the projects are being evaluated, and that risk is not being transferred between communities. The WSLIP represents an important subarea of the SRFCP and merits such study, heightened by West Sacramento's downstream location.

To further demonstrate the need for action, details about West Sacramento's flood risk and the consequences of levee failure in West Sacramento are described in the chapter 3 of the EIS/EIR. Additional context for the objectives of, purpose of, and need for the WSLIP can be found in Chapter 1 of the EIS/EIR.

5 Description of the Proposed Modification

5.1 Overview

The CHP Academy and The Rivers Projects will address deficiencies in the West Sacramento Basin in order to meet the WSLIP's design objectives. A typical levee cross section with a slurry wall is shown in Plate 2.

5.2 The CHP Academy Project

Project Applicant Preferred Alternative – Slurry Cutoff Wall and Waterside Slope Flattening

The CHP Academy Project (Project) consists of a combination of a slurry cutoff wall and slope flattening. To address under- and through-seepage concerns, a slurry cutoff wall varying in depths from 25 to 75 feet deep below the degrade elevation is proposed. The slope flattening treatment is proposed to alleviate geometry deficiencies. The waterside slope would be flattened to a 3:1 slope shifting the levee prism centerline 10 to 20 feet landward. Improvements constructed on the landside of the levee may consist of reconstructing the landside stability berm, interior drain and toe drain system. All alternatives would occur within the construction limits, which are bounded on the landside by the Project property fence. The 2,450 linear feet of concrete cap on the waterside slope adjacent to the weir would be demolished and removed before slurry cutoff wall and slope flattening construction and replaced after construction is complete. The staging area for equipment is an approximate 4.7 acres within the bypass and adjacent to the levee (2.6 acres in bypass and another 2.1 acres of toe road). The southern boundary of the construction limit of work is the Project fence line; therefore, the Project property would not be affected by construction.

TREATMENTS

Slurry Cutoff Wall

A 75-foot-deep by 3-foot-wide slurry cutoff wall is proposed to be constructed from station 18+00 to station 52+00 and a 25-foot-deep by 3-foot-wide slurry cutoff wall is proposed to be constructed from station 52+00 to station 61+75. The levee would be degraded and then the conventional slot trench method would be used to construct the wall. During slurry cutoff wall construction, one crew would be able to construct approximately 40 to 50 linear feet of slurry cutoff wall in an 8-hour shift. Mixing areas would be located at the staging area. The mixing area would be used to prepare the soil-bentonite mixture and supply bentonite-water slurry. The mixing area would be contained by installing erosion control materials in accordance with the Stormwater Pollution Prevention Plan (SWPPP) to avoid dispersal of inadvertently spilled mixing materials. Vertical clearance of about 40 feet would be needed

for the excavator boom. Horizontal clearance of about 30 feet beyond the levee crest may be required for excavator swing when loading dump trucks. Dump truck trips would haul material between the excavator and the mixing area along the levee.

Slope Flattening

To flatten the waterside slope, the waterside slope would be trimmed and reshaped to a 3:1 slope the full length of the site. After slope flattening, the levee crown would be a minimum of 20 feet wide, and the levee prism centerline would shift 10 to 20 feet landward. The existing waterside hingepoint would move landward and the waterside toe would remain in the same place. On the landside, an interior drain and sub-surface drainage canal presently run the length of the Sacramento Bypass Levee. The drainage canal runs along the landside berm toe and captures water that daylights from an existing interior drain. This drainage canal flows to the westernmost end of the Sacramento Bypass Levee to a pump station that pumps the water over the levee into the bypass. Improvements constructed on the landside of the levee may consist of reconstructing the landside stability berm, interior drain, and toe drain system. All alternatives would occur within the construction limits which are bounded on the landside by the Project property fence. No permanent fill of wetlands or waters of the United States is proposed. Embankment fill material excavated to flatten the slope would be transported to the staging area and, if suitable, reused.

5.3 The Rivers Project

The Rivers Applicant Preferred Alternative—Slurry Cutoff Wall and Landside Slope

The Rivers Project (Project) would be a combination of slurry cutoff wall and landside slope flattening, which would address through-seepage, under-seepage, stability, and geometry deficiencies. The staging area would be located on the levee at the western end of the project site. 11 residences located on top of the levee and 4 residences adjacent to the landside toe of the levee encroaching on the levee operation and maintenance area have been removed from the project reach. The treatments and phases of construction are described in more detail below.

TREATMENT

Slurry Cutoff Wall

A 3-foot-wide slurry cutoff wall would be constructed from station 70+00 to station 101+00 up to a depth of 125 feet below degrade elevation using the DSM method of construction. The DSM method uses a crane-supported set of two to four mixing augers (typically 36 inches in diameter) set side by side. These augers are drilled through the levee crown and foundation to the required depth (capable of a maximum depth of about 200 feet). As the augers are inserted and withdrawn, a cement-bentonite grout is injected through the augers and mixed with the native soil. An overlapping series of mixed columns is drilled to create a continuous slurry cutoff wall panel.

To provide a working platform on the levee crown with adequate width, 147,000 cubic yards of embankment fill material would be excavated and hauled from the project site and disposed of at a permitted site within 20 miles of the project site. An excavator would manipulate injector return spoils near the DSM rig, and transport trucks would be used to haul spoils to an appropriate disposal area. A crane would be used for in-place sampling of DSM material and also for loading bentonite into the batch plant hopper. A mobile batch plant (diesel-powered) is required near each DSM rig at the work area to prepare the cement-bentonite grout. The grout is transported to the DSM rig through flexible hoses. The batch plant would require a pad of 50 by 100 feet within the staging area. Hauling at the work area would include scraper runs along the levee to the staging area and cement and bentonite deliveries to the batch plant.

During DSM slurry wall construction, one DSM rig typically can construct 20 linear feet of DSM wall per day (for wall depths up to 120 feet).

Slope Flattening

The existing landside slope of the levee is steep and requires flattening to meet appropriate slope stability and levee geometry requirements. The waterside slope would be trimmed and reshaped to a 3:1 slope the full length of the site (pending USACE approval based on engineering analysis to support a slope steeper than 3:1). The landside toe would remain at the same point.

6 Non-Federal Request for Project Modification

The State of California, Central Valley Flood Protection Board (**CVFPB**) has requested permission to alter the Sacramento River West Levee at the Rivers site and the Sacramento Bypass South Levee at the CHP Academy site, segments of a Federal Project levee. This request is formally provided to the CVFPB by means of two encroachment permit applications (Permits 18313-1 and 18313-2, for the CHP Academy and The Rivers projects, respectively), submitted by WSAFCA in March 2010. WSAFCA is continuing to coordinate closely with the CVFPB and the USACE on finalizing the design and permitting of these projects.

The CHP Academy and the Rivers projects will be implemented consistent with the Corps' current levee vegetation standards as set forth in ETL 110-2-571.

7 Related and Ongoing Studies

This section provides an overview of other flood management activities that comprise the regional planning context for the WSLIP.

7.1 Sacramento Metropolitan Area, California, Feasibility Report (West Sacramento Project)

The *Sacramento Metropolitan Area, California, Feasibility Report* (also known as the West Sacramento Project) was completed in 1992 and describes the results of studies of flood problems along the Sacramento River and Yolo Bypass from the Sacramento Weir downstream to an area just south of Freeport. The West Sacramento Project included plans for improving flood protection for the city of West Sacramento. The study area is located along the right bank of the Sacramento River in Yolo County, California. The West Sacramento Project was substantially completed in 2002. The project involved raising more than 1 mile of the south levee of the Sacramento Bypass by up to 5 feet and raising 4.5 miles of the Yolo Bypass levee by up to 5.5 feet. Two deficient sites remain under this project and are scheduled for completion by 2010.

7.2 West Sacramento General Re-Evaluation Report

The original West Sacramento Project of 1992, described above, studied only a small portion of the levees that provide flood protection for the city of West Sacramento. As introduced earlier in this chapter, presently, the USACE and WSAFCA are developing a GRR for West Sacramento levee improvements to assess the entirety of the levees protecting the city of West Sacramento in light of most recent criteria and knowledge regarding levee design.

USACE uses GRRs to present the results of a reevaluation of a previously completed study, using current planning criteria and policies, due to changed conditions and/or assumptions. The results may reaffirm the previous plan, reformulate and modify it, or find that no plan is currently justified. The results are documented in a GRR which, if recommended and supported, also serves as the decision document for a Federal action (U.S. Army Corps of Engineers and Central Valley Flood Protection Board 2009). NEPA analysis for the GRR will be separate from that for the WSLIP, but the processes being closely coordinated for consistency and efficiency.

The primary objective of the West Sacramento GRR is to determine the extent of Federal interest in additionally reducing the flood risk within the study area while concurrently exploring opportunities to increase recreation and restore the ecosystem along the Sacramento River within the study area. USACE anticipates completion of the GRR in 2013.

In regard to the relationship between the WSLIP and the West Sacramento GRR, the WSLIP study area and the GRR study area overlap and the improvements considered may as well. Some improvements evaluated in this EIS/EIR (specifically the EIPs), which would be implemented by WSAFCA, are scheduled to be initiated prior to the GRR authorization, with the expectation that the flood protection improvements that are constructed in advance of any Congressional action on the GRR will be found to be consistent with the recommendations contained in the GRR. On that basis, WSAFCA anticipates that the non-Federal costs incurred in implementation of the WSLIP improvements could be credited against the remaining non-Federal share of the cost of the project studied under the GRR. More specifically, requests for general credit for flood control under Section 104 of the WRDA of 1986 would allow the work conducted by WSAFCA and described in the GRR to be partially credited against the local cost sharing requirements of the West Sacramento Project GRR as long as the project features constructed are compatible with the USACE project. Because

implementation of the improvements by WSAFCA does not immediately use Federal funds, it would not result in a commitment of Federal resources that would prejudice selection of a GRR alternative before a final decision on the GRR alternatives is made. In addition, the project-specific improvements considered in this EIS/EIR (the EIPs) are limited to a small portion of the overall flood protection system considered in the GRR. In summary, the WSLIP is being advanced by WSAFCA to facilitate EIPs and a program evaluation that are intended to be consistent and compatible with the ultimate West Sacramento Project GRR.

7.3 Sacramento River Deep Water Ship Channel Project

The Sacramento River Deep Water Ship Channel Project was originally authorized by Congress and implemented by USACE in 1986. The project involved deepening the existing 46.5-mile DWSC from 30 feet to 35 feet and widening portions of the channel to improve navigational efficiency for movement of goods and safety. Construction was initiated in 1989, but work was suspended in 1990 because of a lack of local share funds to match Federal funds and issues related to unresolved infrastructure relocation. A portion of the channel was deepened to the authorized depth of 35 feet. In 2008, USACE, in coordination with the Port of West Sacramento, started the process of conducting a Limited Reevaluation Study and preparing a joint Supplemental Environmental Impact Statement and Subsequent Environmental Impact Report (SEIS/SEIR) to evaluate the action of resuming construction of navigational improvements to the DWSC. USACE anticipates releasing a draft study and SEIS/SEIR to the public in mid-2010. Construction is anticipated to start mid-2011 and be completed in fall 2013. The project is estimated to produce 6.4 million cubic yards of dredged material. The study and SEIS/SEIR will evaluate the feasibility and beneficial use of providing dredged material to local projects.

7.4 Sacramento Weir Sediment Removal Project

DWR removed approximately 38,600 cubic yards of accumulated sediment from the Sacramento Weir approach to restore its flow capacity (ongoing at the time of writing this EIS/EIR). The average depth of sediment removed is 4 feet with depths ranging from 2 to 5 feet along the length of the weir. After the sediment was removed, the invert elevation directly in front of the weir matches the weir apron elevation of 21.27 feet. The area of cut has an average width of 160 feet from the weir apron to the hinge point of the river bank and a length of approximately 2,100 feet (approximately 7.75 acres). The total area of disturbed ground, including in-channel and overbank haul paths and disposal area, is about 19.2 acres. The excavated sediment was placed along the landslide of the south levee of the Sacramento Bypass. The sediment was placed as fill on the existing stability berm on the levee toe. The sediment raised the existing stability berm approximately 6.3 feet for a 1-mile stretch.

7.5 Central Valley Flood Protection Act

The Central Valley Flood Protection Act, enacted in California in 2005, calls for the DWR to develop a CVFPP by January 1, 2012. The CVFPP will outline a comprehensive system-wide approach for the protection of lands currently protected from flooding by the SRFCP and the corresponding San Joaquin River watershed to the south. It also establishes a new standard of 200-year flood protection for urban areas in the Central Valley and requires this standard to be achieved by 2025.
The people of California also passed two bond measures that provide approximately $5 billion toward flood improvements to reduce flood risk, particularly to state-Federal levees protecting urban areas in the Central Valley. These levee improvements are expected to occur over the next 10 years with much

of the bond money spent after the year 2012. However, there are urgent needs to improve inadequate flood protection in existing urban areas in advance of the overall comprehensive effort. These advance efforts are termed EIPs. EIPs will be implemented ahead of the comprehensive effort, yet be designed to ensure that they do not eliminate opportunity or prejudice flood risk-management alternatives that would provide regional or system-wide benefits. Local agencies and the state are identifying and planning EIPs in a parallel process to be compatible with comprehensive, system-wide studies.
Along with the requirement for increased flood protection by 2025, one of the objectives of the CVFPP is increasing the engagement of local agencies willing to participate in flood protection, ensuring a better connection between state flood protection decisions and local land use decisions (Draft Framework for Early Implementation Projects and Section 408 Approval).
In line with that objective, WSAFCA has proposed the WSLIP.

7.6 Natomas Levee Improvements Program

As part of its long-term program to improve the Natomas Basin levee system, the Sacramento Area Flood Control Agency (SAFCA) proposes to continue waterside and landside levee-strengthening efforts, including levee raises, seepage remediation, increased bank protection, levee stabilization, and flattening of landside levee slopes under the Natomas Levee Improvements Program (NLIP), an EIP. These activities were evaluated in the following environmental documents.

Local Funding Mechanisms for Comprehensive Flood Control Improvements in the Sacramento Area (2007)

Natomas Levee Improvements Program, Landside Improvements Project (2007)

Natomas Levee Improvements Program, Bank Protection Project (2007)

Natomas Levee Improvements Program, Landside Improvements Project- Phase 2 Project (2008)

Natomas Levee Improvements Program, Landside Phase 3 Levee Improvements Project (2009)

Natomas Levee Improvements Program, Landside Phase 4a Levee Improvements Project (2009)

Specific elements are described below.

7.6.1 Natomas Levee Improvement Program Landside Improvements Project

SAFCA proposes to provide the Natomas Basin with at least a 100-year level of flood protection by the end of 2010 and ultimately a 200-year level of flood protection. Approximately 26 miles of levees surrounding the Natomas Basin require one or more forms of remediation to address the potential for failure in a 100-year or 200-year flood event. This will require improving conditions along the Natomas Cross Canal South Levee and the Sacramento River East Levee, American River North Levee, Natomas East Main Drain, and the Pleasant Grove Creek Canal. This is a

four-phase construction program: Phase 1 occurred in 2008, Phase 2 in 2009, and Phases 3 and 4 are scheduled for 2010.

7.6.2 Natomas Levee Improvement Program Waterside Improvements Project

SAFCA proposes to implement bank protection measures at nine sites along the left bank of the Sacramento River to allow FEMA to certify the levee and to meet SAFCA's 200-year flood protection standard. The project will address erosion and scour, which can threaten levee integrity and ultimately cause levee failure. SAFCA has determined that repair of both moderate and high risk sites is needed to ensure FEMA certification and meet SAFCA standards. Approximately 8,500 linear feet of bankline have been identified for repairs at the nine proposed sites, which are located on the left bank of the Sacramento River between River Mile (RM) 69 (upstream of the confluence with the American River and 2 miles downstream of the Interstate 5 river crossing) and RM 79 (the confluence with the Natomas Cross Canal).

7.7 Sacramento River Flood Control System Evaluation

Following the flood of 1986, USACE and the State of California, along with local partners, completed a comprehensive evaluation of the Sacramento River Flood Control System and initiated a flood risk management program aimed at repairing, raising, and strengthening urban levees, among other activities. This effort, known as the Sacramento River Flood Control System Evaluation (commonly referred to System Evaluation) resulted in the repair of more than 70 miles of deficient levees. However, to date, not all the authorized repairs have been completed. Moreover, the completed repairs were built to less rigorous standards than current standards.

7.8 Sacramento–San Joaquin Rivers Comprehensive Study

Following the 1997 flood, the Sacramento-San Joaquin Comprehensive Study was initiated by the state and USACE to formulate comprehensive plans for flood risk reduction and environmental restoration. This study was unable to stimulate widespread public or political interest in flood risk reduction or environmental restoration activity beyond the ongoing urban levee improvement programs. The study did result in a new set of engineering criteria for the design and evaluation of urban levees and a greatly expanded scope and cost for the ongoing urban levee improvement efforts on the Sacramento and American Rivers. In addition, the adequacy of previous repairs was reviewed.

7.9 American River Common Features Project

To increase flood protection for the city of Sacramento, which is bordered by the left bank of the Sacramento River, the American River Common Features Project (Common Features) was authorized by Congress in the WRDA of 1996. This authorization called for strengthening the north and south levees of the American River and raising and strengthening the upper 12 miles of the left levee of the Sacramento River in the Natomas area, just north of the city of Sacramento. These improvements were considered *common features* of any comprehensive plan of flood protection for the Sacramento area that might ultimately be approved by Congress. In WRDA of 1999, the scope of the Common Features authorization was expanded to include raising portions of the north and south levees of the American River (including the Mayhew Levee), additionally strengthening portions of the north levee of the American River, and raising and strengthening the north and south levees of the Natomas Cross Canal in the Natomas area. In 2006, the Common Features authorization was deemed sufficient to

cover improvements to the left levee of the Sacramento River near the Pioneer Reservoir and in the Pocket/Freeport area.
USACE is currently developing two post-authorization change studies. The Common Features GRR is reevaluating the previous Common Features project and identifying levee improvements needed to provide the city of Sacramento and the Natomas area to the north with at least a 200-year level of flood protection. The Natomas Post-Authorization Change Report will document the evaluation of features in the Natomas Basin only. Both are expected to be presented to Congress in 2010.

7.10 Sacramento River Bank Protection Project

USACE is responsible for implementation of the Sacramento River Bank Protection Project (Sac Bank) in conjunction with its non-Federal partner, CVFPB. The SRBPP is a continuing construction project authorized by Section 203 of the Flood Control Act of 1960. The purpose of this project is to provide protection to the existing levee and flood control facilities of the SRFCP. To date, work has been carried out in two phases, with a total of about 820,000 feet of river stabilized under the project. Phase I consisted of 435,000 feet and Phase II's original authorization included 405,000 feet. Current SRBPP work is being conducted under Phase II of its existing Federal authorization, with approximately 14,000 feet remaining to be constructed in 2009–2010. Projects within the WSAFCA service area are being evaluated under this program.

7.11 Flood Control and Coastal Storm Emergency Act

The Flood Control and Coastal Storm Emergency Act (PL 84-99) authorizes USACE to undertake activities including disaster preparedness, advance measures, emergency operations, rehabilitation of flood control works threatened or destroyed by flood, protection or repair of federally authorized shore protective works threatened or damaged by coastal storms, and provisions of emergency water due to drought or contaminated source. PL 84-99 establishes an emergency fund for emergency response preparations for natural disasters, for flood fighting and rescue operations, and for rehabilitation of flood control and hurricane protection structures. Under PL 84-99, an eligible flood protection system, such as the SRFCP, can be rehabilitated if damaged by a flood event. USACE has the responsibility to coordinate levee repair issues with interested Federal, state, and local agencies following natural disaster events where flood control works are damaged.
The state of California experienced a series of storms affecting federally authorized flood damage reduction projects between December 28, 2006, and January 9, 2007. High water elevations associated with these storms resulted in damage to levees along the Sacramento River and its tributaries. These damages included the development of boils at a site located along the right bank of the Sacramento River in RD 900. This site was located near Davis Road at RM 54.2. USACE, in cooperation with CVFPB, constructed a seepage berm at this site in 2007 under the general authority PL84-99. The 80-foot-wide by 200-foot-long seepage berm, consisting of drain rock encapsulated in geotextile fabric topped with levee fill, was placed at the landside toe of the levee over the area of reported boils.

8 Environmental Considerations

The Public Draft EIS/EIR was prepared in May 2010 in accordance with NEPA and the Council on Environmental Quality regulations. It describes the existing environmental resources in the project area and provides a project-level analysis of the environmental

effects of the Projects and a program-level analysis of the environmental effects for the WSLIP. The EIS will facilitate USACE planning and regulatory activities in connection with the WSLIP.

9 Public Interest Determination

Proposed Federal projects are to be reviewed to determine a project's probable impacts (including cumulative impacts) on the public interest (33 CFR §320.4). The public interest review is described as a balancing of the benefits which reasonably may be expected to accrue from the proposal against its reasonably foreseeable detriments, with consideration of the national concern for both protection and utilization of important resources (33 CFR §320.4). In the case of the proposed Project, this review was conducted in an Environmental Impact Statement (EIS) completed for the purposes of complying with NEPA (40 CFR §1508.9). The draft EIS analyzed the potential impacts (including cumulative and growth-inducing impacts) of the proposed Project and two alternatives on all relevant resource areas, including aesthetics, agriculture and land use, air quality, sensitive species and wetlands, cultural resources, hazardous waste, hydrology and water quality, noise, recreation, and transportation (ICF Jones & Stokes, May 2010). The alternatives analysis of the draft EIS determined that the proposed Project provides the best balance between expected benefits (in this case improved flood control, improved riparian habitat conditions, and reduced levee maintenance requirements).

Through public outreach campaigns during development of the EIR and the EIS, numerous local, county, and state agencies and individuals from the public have provided input and support of the proposed Project. On February 12, 2009, a public scoping session was held at the Galleria in the City of West Sacramento, California. At that session the proposed Project and environmental review process were discussed, and the public was invited to provide comments on the project and the scope of the environmental review. Comments provided at the public scoping session were considered in preparing the proposed Project's draft EIS and EIR. On May 28, 2010, a 45-day public review period of the proposed Project's draft EIS/EIR was initiated. Comments received during the public review period were incorporated into the final EIS/EIR. The WSAFCA Board is scheduled to review and formally adopted the final EIR at a public hearing in October 2010.

The general policies for conducting a public interest review included in 33 CFR §320.4, include three general criteria to be considered in the evaluation of every Federal project:

1) The relative extent of the public and private need for the proposed structure or work: As mentioned in Section 3 of this Project Summary Report, the deficiencies identified in the Project levees pose significant threats to public safety, property, and infrastructure during flood events such as the 100-year. Without the proposed Project and without future improvements to other parts of the flood protection system, residents, their property and infrastructure will remain vulnerable to an unacceptable high risk of flooding;

2) Where there are unresolved conflicts as to resource use, the practicability of using reasonable alternative locations and methods to accomplish the objective of the proposed structure or work. Three alternatives to the proposed Project were evaluated in the EIS/EIR to determine if there were more benign ways to improve flood control in the area. The No Action Alternative, which would involve emergency repairs to the existing levee as needed, would not provide an adequate level of flood control or provide any benefits to the riparian ecosystem. Additionally, repairs done under emergency conditions are less likely to include avoidance, mitigation and BMPs measures (which the proposed Project does) and short-term impacts associated with emergency repairs would, over time, be cumulatively more significant than those of the proposed Project. The proposed action evaluated, the Levee Fix-in-Place Alternative, would strengthen the existing levee with a slurry wall.

3) The extent and permanence of the beneficial and/or detrimental effects which the proposed structure or work is likely to have on the public and private uses to which the area is suited. NEPA policy is to assess and avoid, as practical, all the potential impacts of a Federal action to the environment in an effort to "foster and promote the general welfare" (42 USC 4331, Section 101). The EIS/EIR assessed short- and long-term effects of the proposed Project and its alternatives, as well as cumulative and growth-inducing effects. From this assessment it was determined that the proposed Project will have no significant short- or long-term negative direct or indirect effects.

The measure of public interest and support for the West Sacramento Levee Improvement Program was validated by the citizens of the City of West Sacramento by passage of the City of West Sacramento Flood Assessment in July 2007. Property owners in the City of West Sacramento Area overwhelmingly approved, 70% to 30% margin, the establishment of a new flood control Assessment. The Assessment District will generate $37 million to fund the local share of projects needed to achieve 200-year flood protection for the City of West Sacramento.

In addition to the public meetings held due to the statutory requirements in NEPA and CEQA, WSAFCA has performed other public outreach activities. Some of these activities include:

1) Attending community and neighborhood association meetings to brief residents on the status of flood control and improvement efforts.

2) Articles in the City Lights Newsletter are sent to residents, neighborhood leaders and stakeholders; which provides up-to-date information about flood control in the City of West Sacramento and periodic updates on the status of the WSLIP.

3) Participation in workshops that include information regarding flood insurance in the City of West Sacramento.

4) City is developing an application to join The National Flood Insurance Program's (NFIP) Community Rating System (CRS) and as a condition of acceptance into the CRS the City will be required to hold workshops regarding flood insurance.

5) Participation (booths) at local community events/festivals.

6) Minimum 60-day advance notification of construction activity and pre-construction offer for temporary relocation to those directly affected by construction (e.g. dust, noise, vibration).

7) Small group meetings with residents that may be directly affected by project construction.

8) Establishment of a Flood Control webpage on the City of West Sacramento web site, which includes links to all newsletters, environmental documents, studies and reports and relevant media stories produced.

10 Executive Order 11988

Executive Order 11988 (May 24, 1977) requires Federal agencies to prepare floodplain assessments for proposed actions located in or affecting floodplains. If an agency proposes to conduct an action in a floodplain, it must to the degree possible avoid short and long term adverse effects associated with the occupancy and the modification of a floodplain and to avoid direct and indirect support of floodplain development whenever there is a reasonable and feasible alternative. If the only reasonable and feasible alternative involves sitting in a floodplain, the agency must minimize potential harm to or in the floodplain and explain why the action is proposed in the floodplain. The WSLIP proposes to improve existing flood protection facilities and does not directly or indirectly propose floodplain development.

Step 1: Determine if a proposed action is in the base floodplain (100 year floodplain or 1% chance flood or 500 year or 0.2% if the action falls under the definition of critical, discussed separately below). The WSLIP and proposed EIPs are activities located primarily on the high ground and levees around West Sacramento and as such are not directly within the base 100 year floodplain but would improve the current level of protection ultimately to the goal of 200 year protection. The proposed improvements are described in Chapter 2 at the program level and Chapters 4 and 5 at the project level (for CHP Academy and The Rivers, respectively), including location, construction methods, and operations and maintenance activities. The Water Resources Council Floodplain Management Guidelines presented the concept of a critical action. While there is no precise definition of critical action, the guidelines (under Part II, Decision Making Process, Step 1C) outline the parameters of critical actions. To summarize, as noted in the guidelines, a critical action is "any activity for which even a slight chance of flooding is too great." This definition is intended to apply to Federal actions where that action would involve facilities or infrastructure that are sensitive to flooding, where the consequences of flooding would be severe in terms of ability to provide essential community services or to protect life and welfare (as described in the

criteria above). Under the WSLIP, it is the levee improvement program itself that will reduce the chance of flooding, rather than being sensitive to or compromised by flooding; i.e., its purpose is to manage flood risk. Therefore, the WSLIP and its EIPs are not considered a critical action because they are intended to withstand flood conditions, reduce flood risk, and increase flood protection.

Step 2: Provide public review. The NEPA/CEQA process provides for public disclosure; this EIS/EIR is one instrument for public review of the WSLIP and proposed EIPs. As discussed in Chapter 1, USACE and WSAFCA have established a proactive multi media outreach program to communicate the WSLIP and allow for public review and disclosure. The approach to the outreach program has been to go beyond the guidelines and requirements of NEPA and CEQA for public noticing to ensure the affected community and other interested stakeholders are informed, engaged, and involved through an accessible, open, and transparent process. Thus far, the outreach program has included the following actions:

- four scoping meetings for the environmental document (two for the joint NEPA/CEQA document and two prior for CEQA only);
- publication of notices in local newspapers of major circulation;
- publication in the Federal Register;
- notification to the State Clearinghouse;
- posting NEPA notices on the USACE website;
- posting CEQA notices and project information on the City/WSAFCA website;
- publication of feature articles in the City Lights newsletter, distributed quarterly to all city residents for updates and information about City business;
- presentation and discussion of the status of the WSLIP at various public meetings for elected boards and commissions;
- direct mailing to residents within proximity of proposed construction activities;
- phone calls to public agencies;
- small group meetings with interested stakeholders; and
- posting of notices in public places.

As the proposed improvements and EIS/EIR are further developed, the outreach program will continue in a broad sense via the methods listed above and will expand through more targeted specific outreach to residents and businesses who might be more directly affected by construction or operation of the proposed improvements. To date, the results of the outreach program have been very favorable, constructive, and supportive for the WSLIP. The tone and substance of the input has been consistent with the very favorable response for the voter approved assessment to fund the local share of the WSLIP. Comments received from the public have been considered to refine the project description and the environmental analysis. A more detailed accounting of the scoping process is provided in the WSLIP Draft EIS/EIR.

Step 3: Identify and evaluate reasonable and feasible alternatives to locating in the base floodplain. Firstly, it should be noted that previously West Sacramento has not been mapped in the base floodplain, and land use planning decisions have been based on studies demonstrating protection from the base flood. Only recent studies (as described in Chapter 1)

based on evolving levee standards now necessitate improvements to continue maintaining protection above the base floodplain. The proposed action (the WSLIP) is specifically targeted to provide such improvements and exceed the level of protection beyond the base flood to that of the 0.5% chance (200-year) flood event or better.

General engineering and environmental analyses have been performed for the program and project level alternatives for the WSLIP, following an identification and screening process discussed in Chapter 2, Alternatives. Detailed analyses were performed for the project level alternatives and have found the proposed action to be the only practicable alternative that achieves the objectives of the project. Construction of the WSLIP will remove thousands of transportation, commercial, institutional, and residential structures and nearly 50,000 residents out of the base floodplain.

Step 4: Identify the impacts of the proposed action. This EIS/EIR analyzes the environmental effects potentially resulting from the WSLIP and proposed EIPs per NEPA/CEQA requirements. Review under the Endangered Species Act, Clean Water Act, Clean Air Act, and other Federal and state environmental regulations is also occurring in coordination with the EIS/EIR. Program level impacts are disclosed and analyzed in Chapter 3 and project level impacts for the EIPs are in Chapters 4 and 5 (for CHP Academy and The Rivers, respectively). In brief, the CHP Academy EIP may have temporary construction related effects on roadways, air quality from heavy equipment use, and biological resources (due to temporary disruption of or construction near habitat). The Rivers EIP may have temporary construction related effects on roadways; temporary effects on biological resources (due to temporary disruption of or construction near habitat); and temporary construction related effects on residents due to noise generation, changes in visual quality, and interruption in utility service and property access.

Step 5: Minimize threats to life and property and to natural and beneficial floodplain values. Restore and preserve natural and beneficial floodplain values. The WSLIP and proposed EIPs would reduce flood risk for West Sacramento and increase protection for life and property within the city. The existing levee system was originally designed and constructed to provide a minimum level of protection from the base flood and ensure that human life and structures are out of the floodplain. The WSLIP target is to maintain and increase the level of protection beyond that of the base flood to a minimum 200 year protection (0.5% chance). The existing floodplain on the waterside of the levee would be largely unchanged; however, setback levees are evaluated as part of the program and may be proposed as appropriate measures for some segments, thereby allowing for preservation and enhancement of riparian habitat another natural and beneficial floodplain values.

Step 6: Reevaluate alternatives. This EIS/EIR is part of a step wise evaluation process to refine the alternatives through public review as well as through resource and regulatory agency input in consultation for compliance with the Clean Water Act, Endangered Species Act, and other project authorizations. The alternatives have been evaluated at the planning level for initial screening (in Chapter 2), through programmatic analysis for secondary screening(Chapter 3), and re evaluation through project level analysis (Chapters 4 and 5).

The alternatives are also continuously evaluated on a technical basis through independent review of the design documents (i.e., plans and specifications) at several levels of design development, including expert peer review by a Board of Senior Consultants. The recommendations and design refinements resulting from these reviews have been incorporated in the program description and environmental commitments (Chapter 2), resource analyses and findings (Chapters 3, 4, and 5), and project level analyses and mitigation measures (Chapters 4 and 5). This level of screening analysis has demonstrated that the proposed actions at the CHP Academy and The Rivers sites are the most practicable alternatives.

Step 7: Issue findings and a public explanation. To conclude the NEPA process, a record of decision for the project level action (EIPs) will be publically issued following the Final EIS. To conclude the CEQA process, findings will be publically issued following the Final EIR. A public workshop will be conducted during the draft document stage and a public hearing will be held to decide on project adoption by WSAFCA as an action under CEQA.

Step 8: Implement the action. WSAFCA intends to construct the EIPs as soon as possible based on conclusion of the project approval processes, targeted to be initiated in the 2011 construction season.

In conclusion, the WSLIP and proposed EIPs would reduce the risk of flood loss and minimize the impact of floods on human health, safety, and welfare by improving existing flood management infrastructure, and would increase protection for existing urban development and remove a potential obstacle to future growth. Because there is no reasonable and feasible alternative to the urban development indirectly associated with the WSLIP and proposed EIPs and because the actions will improve flood protection, it is not in conflict with Executive Order 11988. This EIS/EIR further complies with this Executive Order by identifying the most reasonable and feasible flood improvement alternative and disclosing the potential effects of actions under the WSLIP that may lead to growth or other direct and indirect effects. Additionally, EIS/EIR Chapter 1, Introduction, and EIS/EIR Chapter 2, Alternatives, explain why levee improvements are necessary for West Sacramento, regardless of how they may affect future development and growth.

11 Effects of the Proposed Modification

This section provides a summary of the indirect effects of the WSLIP.

11.1 Flood Control and Geomorphic Conditions

The proposed program could contribute to cumulative effects on flood control and geomorphic conditions resulting from a levee raise, levee setback, or seepage control treatment. As described in the EIS/EIR Section 3.2, Flood Control and Geomorphic Conditions, levee raises may cause slight increases in upstream water surface elevations and the proposed levee setback may cause slight increases in downstream elevations and flows. Additionally, seepage control treatments may transfer seepage risk to areas adjacent to the treatment.

Hydraulic modeling was used to determine some of the cumulative effects of levee raises, including flood walls and setbacks. Although a slight change in upstream and downstream conditions is expected to result from program alternatives, this change is less than significant.

Based on the quantitative results from the 2009 MBK Engineers modeling effort, upstream water levels would not be significantly affected by the proposed levee raises or other levee improvements either, assuming that all upstream levee strengthening components are eventually implemented.

Levee raises or setbacks and installation of stop logs or floodwalls could represent an unacceptable transfer of flood risk to adjacent or downstream levee districts. However, as described in MBK Engineers (2009), modeling effort for the WSLIP, raising and strengthening portions the Federal project levee system protecting West Sacramento and implementing in channel erosion protection measures would not result in any significant hydraulic effects on other sub basins protected as part of the Flood Control Project. Furthermore, these improvements would be consistent with the principles that have guided the management of the Flood Control Project over the past century and with the policies adopted by the state legislature calling for an immediate and comprehensive effort to increase the level of flood protection provided to West Sacramento and the other urban areas within the Flood Control Project.

Restoration in the Yolo Bypass as proposed in the current Bay Delta Conservation Plan, Delta Vision, and other projects would further increase the flood capacity of the Sacramento River downstream of West Sacramento. It is also important to note that many of the areas adjacent to the West Sacramento levees (excluding the City of Sacramento), are rural and have been designed to flood as part of the overall Sacramento River flood control operation. As such, it is not expected that there would be a significant cumulative effect related to the WSLIP.

With respect to mean sea level change and its effects on the program area, the WSLIP program area is relatively insensitive to the rates of sea level rise. Of all the scenarios analyzed, only the high sea level rise rate 100 years after the project is constructed shows greater than one tenth of a foot stage increase in the Sacramento River, Yolo Bypass, or Sacramento Bypass in the WSLIP program area (MBK Engineers 2009b).

The Port of West Sacramento and the Deep Water Ship Channel see larger increases due to sea level rise. The Deep Water Ship Channel is primarily backwater controlled and is hydraulically connected to the rest of the flood system fairly close to the sea (i.e., North Delta). The WSLIP design for the Deep Water Ship Channel indicates there is adequate freeboard available to accommodate a water surface increase of the magnitudes reported herein due to sea level rise and still maintain the minimum project design freeboard of three feet (MBK Engineers 2009b).

11.2 Water Quality and Groundwater Resources

No groundwater resources would be affected by the WSLIP and, therefore, there would be no cumulative effects. The proposed treatments could affect water quality during construction by increasing turbidity, thus increasing the potential for and accidental release of hazardous materials. Cumulative effects could occur if other projects were constructed at the same time. Many of the West Sacramento development projects and other levee improvements by WSAFCA could contribute to localized and temporary effects on water quality. As described in the water quality section, many minimization measures, including a SWPPP, would be implemented, turbidity would be monitored during construction to ensure it stays within the acceptable level identified by the RWQCB, and NPDES permit and WDRs would be obtained to limit discharge into the water table. These minimization measures are standard construction practices and it is assumed that other projects would also implement them. On completion of construction, no additional effects on water quality would occur as part of the WSLIP. As such, there would be no significant cumulative effect.

11.3 Geology, Seismicity, Soils, and Mineral Resources

The WSLIP could result in both beneficial and significant effects on geology, seismicity, and soils. There would be no effect on mineral resources, and therefore no cumulative effects associated with the WSLIP. Other earth-moving activities in the WSLIP area, such as development, could change the stability of soils, increase erosion and sedimentation, and expose structures to groundshaking and liquefaction. Soil stability is addressed through engineering design of structures, including levees, and ground-disturbing activities are required to stabilize soils upon completion of construction or even between stages of construction. As such, no significant cumulative effects related to soil stability are anticipated. A cumulative increase in erosion and sedimentation could occur if other levee improvement projects on the Sacramento River are occurring at the same time. The potential for erosion and sedimentation resulting from the WSLIP and other projects is limited by minimization measures and implementation of a SWPPP. Any cumulative effect would be temporary and minimal, and therefore less than significant. The WSLIP replaces or upgrades

existing flood control facilities (i.e., levees) and there would be no change in risks due to seismicity. However, there could be cumulative effects related to construction of structures that could be subject to seismic activity. The program area is not located within an active seismic area, and therefore any cumulative increase in risk related to groundshaking would be less than significant.

11.4 Transportation and Navigation

Construction activities associated with the WSLIP have the potential to result in short-term disruptions to roadways, including closures, increases in emergency response time and road hazards, effects on alternate transportation modes, disruption to navigation, temporary loss of service to railroads, and decreases in Level of Service (LOS) for roads accessed or used for detours during construction. Combined with other projects in West Sacramento and along the Sacramento River, there could be significant cumulative effects on transportation if the WSLIP and other projects are implemented at the same time. Specifically, cumulative effects would occur if projects required closing or detours on multiple major roadways at the same time resulting in decreased access to areas within West Sacramento or a cumulative LOS lower than Level C or D, depending on the location of the road (See the EIS/EIR Section 3.5, Transportation and Navigation for a description of where these standards apply). With implementation of the environmental commitment to coordinate with the City to ensure minimal overlap in disturbances to traffic during WSLIP construction, these effects would be less than significant. In addition, the WSLIP may result in cumulative effects on railroad lines and services if the WSLIP and other projects that would require temporary closure of railroad tracks were implemented at the same time. WSAFCA will implement the environmental commitment to coordinate construction periods with railroad service officials to minimize potential effects, but dependent upon construction conditions, cumulative effects to railroad transportation could still be significant and unavoidable. Cumulative navigation effects could occur, but the WSLIP's contribution to these effects would be minimal because waterside work would be limited to the area adjacent to the levee. The river is wide enough to accommodate boat and other navigational traffic in the channel during construction and program activities would not result in navigability changes once construction is complete. Other projects that would affect navigability in the Sacramento River are also not likely to change access due to the river's width. No significant cumulative effects would occur.

11.5 Air Quality and Climate Change

The WSLIP would result in temporary construction related emissions that would be mitigated by reducing vehicle and equipment emissions and implementing a fugitive dust plan. Other projects occurring in the Yolo/Solano Air Quality Management District (YSAQMD) at the same time as WSLIP construction would result in cumulative effects that would be significant, particularly ROG, NOx, and PM10. It is expected that projects generating these pollutants would also minimize emissions through dust control and vehicle emissions control. However, there could still be a significant unavoidable cumulative effect.

Additionally, the project combined with other projects would result in a cumulative increase in greenhouse gas emissions. Even with emissions reduction mitigation that would be incorporated into the WSLIP and other projects, this cumulative effect is significant and unavoidable.

11.6 Noise

The WSLIP would result in substantial increases in noise levels and vibration at sensitive receptors during construction. Other projects in the vicinity of these receptors occurring at the same time as the WSLIP could result in cumulative effects. Because construction noise would be temporary and highly localized, the WSLIP is not anticipated to make a cumulatively considerable contribution to noise effects in the program area.

Similarly, permanent noise increases associated with WSLIP relief well pumps near sensitive receptors combined with other noise increasing activities could result in a cumulative effect. Mitigation Measure NZ MM 3 would help control pump noise. Because the pumps would be designed to minimize noise at these receptors, the WSLIP's contribution to this cumulative effect is not considerable, and this cumulative effect is not significant.

11.7 Vegetation and Wetlands

The WSLIP would result in direct loss of vegetation as a result of construction and implementation of the USACE policy of removing vegetation from the levee prism. Implementation of this policy along all of the Sacramento River levees would result in a significant cumulative effect, to which the WSLIP would make a considerable contribution. Some of the improvements proposed under the WSLIP and other projects would expand the floodplain within the levee and provide opportunities for habitat restoration. Although there could be limited opportunities to restore or preserve vegetation in areas that are not within the jurisdictional levee prism, the majority of the Sacramento River levees, especially in the West Sacramento area, do not have areas suitable for vegetation under the USACE policy. Restoration activities in the Delta and San Joaquin River could restore some of the vegetation lost as a result of projects along Sacramento River, but there would still be a substantial net loss. This would result in a significant cumulative effect that cannot be mitigated. This cumulative effect would be significant and unavoidable.

Similarly, the levee improvements could result in loss of wetlands. The WSLIP includes mitigation to ensure no net loss of wetlands and therefore there would be no considerable contribution to any cumulative effects on wetlands that may occur as a result of implementing other projects.

11.8 Fisheries and Aquatics

Most of the WSLIP treatments would result in construction related degradation of fish habitat as a result of sedimentation and turbidity, accidental release of contaminants, noise, vibrations, or other disturbances. Combined with other projects occurring near the WSLIP,

there could be significant cumulative effects. The WSLIP's contribution to these cumulative effects is not considerable because it would be temporary and minimized by implementation of a SWPPP and limiting construction activities to times when species are not present.

A few of the improvements would result in permanent loss or degradation of habitat, primarily through the removal of vegetation per the USACE policy or placement of riprap on the waterside of levees. Other levee projects along the Sacramento, Yuba and Feather Rivers would result in similar losses. Restoration activities in the Sacramento River, Delta, and San Joaquin River, including construction of levee setbacks, could offset loss of habitat for the fish that would be affected by the WSLIP. However, there would still be a substantial net loss of habitat, and this cumulative effect is significant and unavoidable.

11.9 Wildlife

The WSLIP would result in some direct take of species, which would be mitigated on or off site in coordination with the resource agencies. The primary cumulative effect on wildlife is related to removal of habitat. As described above under vegetation and wetlands and fisheries and aquatics, this effect would significant and unavoidable because it would occur along the entire Sacramento River levee system and there are limited opportunities to offset this loss. Additionally, many of the species that would be affected by the WSLIP and other similar projects rely on riparian or other habitat associated with the river system. The direct loss of species can be offset through coordination with resource agencies. Because these species are protected under applicable state and Federal laws, other projects would also minimize take and compensate for loss of species and their habitats. However, the WSLIP would result in a significant and unavoidable cumulative effect resulting from the removal of vegetation from the levees.

11.10 Land Use and Agriculture

Some of the WSLIP treatments could result in the conversion of some land use types to levee. Overall, the land use designation changes would be negligible as described in the EIS/EIR Section 3.11, Land Use and Agriculture. However, in areas adjacent to important farmland, a conversion of up to 111 acres could occur. This acreage accounts for approximately 0.0284% of the 390,250 acres of important farmland in Yolo County. Conversion of agricultural land in Yolo County is a primary concern related to land use and it is a significant cumulative impact. However, the WSLIP's contribution to this cumulative impact is not considerable.

11.11 Socioeconomics

Implementation of the WSLIP could result in temporary disruptions to agricultural and local business activities during construction, a permanent decrease in agricultural production related to the removal of farmland (as described above), and growth in West Sacramento as a result of improved levee stability. The permanent removal of farmland would be minimal compared to the total acres of farmland in the region as described above. Although this is a

significant impact in Yolo County, the WSLIP's contribution would not be considerable. Similarly, the temporary disruption to agricultural and local business activities is not expected to contribute considerably to a cumulative impact.

11.12 Environmental Justice

The WSLIP would not result in environmental justice effects and, therefore, there would be no cumulative effect.

11.13 Visual Resources

The WSLIP would result in temporary changes in the visual quality of construction areas and access roads as a result of construction activities and equipment in areas that do not normally include construction associated views. This effect would make a considerable contribution to a cumulative effect if other projects were occurring at the same time and affecting the same viewer groups along the Sacramento River corridor. This cumulative effect would be significant and unavoidable.

The primary long term effect on visual resources is related to the USACE vegetation removal policy. The Sacramento River corridor includes extensive mature riparian and landscape vegetation. In addition to construction related vegetation removal, the recent USACE levee maintenance requirements prevent the replanting of any woody vegetation on these levees. This vegetation is characteristic of the Sacramento River region and is a highly desirable visual resource. Removal of this characteristic riparian vegetation and mature landscaping would greatly degrade the visual character and quality of the region. The removal of vegetation within the study area, in addition to the region wide levee improvement projects, is considered a cumulatively significant and unavoidable effect on visual resources.

11.14 Recreation

The WSLIP would result in both beneficial and negative effects on recreation. Negative effects would occur as a result of vegetation removal and other construction activities that could disrupt recreation in the channels or along levees, bikepaths, or other trails. Other projects affecting the same channels, bikepaths, or trails could result in a cumulative effect on recreation. This cumulative effect would be less than significant because effects would be temporary and localized, and other facilities would be available for use during construction. The removal of vegetation, however, could result in a significant cumulative effect related to reduction of fish habitat and shade that enhances fishing recreation or other activities that rely on or are enhanced by vegetation on the levee. As this would occur throughout the Sacramento River levee system, this cumulative effect is significant and unavoidable.

Beneficial recreation effects include the addition of recreational facilities, including docks and fishing piers, formal park facilities, habitat zones, a continuous recreational trail, an amphitheater, an extension of the River walk Promenade, and improvements to Bryte Park as part of the WSLIP. The City has also planned for the development of additional recreational

facilities. This would be a beneficial cumulative effect on recreation in the West Sacramento area.

11.15 Utilities and Public Services

The WSLIP combined with other proposed projects could result in cumulative effects related to disruption to utility services, increased rates of landfill use, and expansion of drainage facilities. Cumulative effects related to utility service and landfill use would occur only during construction. Utility service disruptions would be avoided by implementation of Mitigation Measure PUB MM 1: Verify Utility Locations, Coordinate with Utility Providers, Prepare a Response Plan, and Conduct Worker Training. These measures are standard and it is expected that other projects occurring at the same time as the WSLIP would minimize their potential for disruption similarly. Effects on landfill capacity are not expected to be considerable because much of the materials removed from existing levees would be reused, construction would be temporary, and the Central Landfill has plenty of capacity (see the EIS/EIR Section 3.16, Utilities and Public Services). Similarly, drainage facilities would not be expanded as relief wells would only produce up to 70 gallons per minute. As such, there would be no significant cumulative effect.

11.16 Public Health and Environmental Hazards

The WSLIP has the potential to slightly increase risks to the public during construction as a result of equipment and fuel usage. These risks would be minimized through implementation of the SWPPP and other environmental commitments. As these are standard practice for construction projects, it is expected that other projects would implement them and the overall cumulative effect would be less than significant.

The WSLIP would improve flood protection for West Sacramento. It includes all of the flood protection features protecting West Sacramento, but other projects that reduce stress on these levees could result in a beneficial cumulative effect by reducing the overall public risk resulting from levee failure.

11.17 Cultural Resources

No cumulative effects on cultural resources have been identified. Cultural resources are generally not considered subject to cumulative effects because they are either individually directly or indirectly affected in a way that changes the significance of the property or they are not affected in a way that changes the significance of the property.

It is possible that the project could cause a significant effect on historic properties and unidentified buried archaeological resources, including buried human remains, through possible ground disturbance associated with levee repair, construction, and maintenance activities.

The incorporation of mitigation, and compliance with the existing state and Federal laws and the policies set forth in the *City of West Sacramento General Plan*, the *Yolo County General Plan*, and the *Solano County General Plan* would reduce these effects. The cumulative effect on archaeological and architectural resources would be less than significant.

11.18 Residual Risk

Implementation of the WSLIP would substantially lessen the probability of flooding in the City of West Sacramento due to levee failure. However, the Basin would remain subject to flooding. WSAFCA recognizes that the consequences of a flood would increase over time as new development occurs in the City of West Sacramento. If no additional risk reduction measures are implemented, the result would be a steady rise in expected annual damages that would undermine the risk reduction accomplishments of the WSLIP.

To reduce the residual risk, WSAFCA adopted a development fee program that will be used to finance a continuing flood risk reduction program for the City of West Sacramento. Fees will apply to all new structures placed in the 200-year floodplain in the City of West Sacramento assessment district. Funds from this program could help fund the WSLIP and offset any substantial increase in expected damages due to a flood as new development proceeds in the floodplain and to fund future flood risk reduction improvements.

11.19 Transfer of Risk

Raising and strengthening portions the federal project levee system protecting the City of West Sacramento proposed by WSAFCA would not result in any significant, adverse hydraulic impacts or induce flooding to other sub-basins protected as part of the SRFCP. Furthermore, these improvements would be consistent with the principles that have guided the management of the SRFCP over the past century and with the policies adopted by the State Legislature calling for an immediate and comprehensive effort to increase the level of flood protection provided to the City of West Sacramento and the other urban areas within the SRFCP.

The existing levees are superior in height to the surrounding levees and the proposed improvements will continue to support the USACE 1957 design capacity, of which the system was intended to carry. The initial overtopping of the existing levee does not begin until floods exceed the 200-year (0.005 AEP) flood event (assuming no upstream levee failures). It is anticipated that risk analysis results would show very small changes in risk to the SRFCP outside of the City of West Sacramento.

Therefore, in the case of strengthening the Sacramento Bypass South Levee and the Sacramento River West Levee as part of the WSLIP Project, the planned design standard of protecting against the 200-year water surface elevation will neither transfer nor, more importantly, increase flood risk in other areas of the SRFCP. The decreased risk of levee failure does not transfer risk to other areas.

11.20 Growth Inducement

The WSLIP and proposed EIPs would reduce the risk of flood loss and minimize the impact of floods on human health, safety, and welfare by improving existing flood management infrastructure, and would increase protection for existing urban development and remove a potential obstacle to future growth. Because there is no reasonable and feasible alternative to the urban development indirectly associated with the WSLIP and proposed EIPs and because the actions will improve flood protection, it is not in conflict with Executive Order 11988. This EIS/EIR further complies with this Executive Order by identifying the most reasonable and feasible flood improvement alternative and disclosing the potential effects of actions under the WSLIP that may lead to growth or other direct and indirect effects. Additionally, Chapters 1 (Introduction) and 2 (Alternatives) of the EIS/EIR explain why levee improvements are necessary for West Sacramento, regardless of how they may affect future development and growth.

12 Technical Analysis and Adequacy of Design

12.1 Geotechnical Analysis

In 2006 The City engaged a consultant engineering team, led by HDR, Inc., to prepare a problem identification report to determine the type, location, and severity of deficiencies in the WSAFCA flood management system. A draft report was completed in April 2008. Remedial measures were designed to meet USACE seepage exit gradient and slope stability criteria for the 200-year water surface elevation (WSE), and the State of California Department of Water Resources' Interim Levee Design Criteria for urban levees. The remedial measures include the following alternatives, or a combination thereof:

i) Strengthen levee in place to increase levee stability, raise the levee crown, and control through seepage

ii) Setback levees to increase levee stability, improve foundation conditions, raise the levee crown, and control through seepage

iii) cutoff walls to reduce underseepage beneath the levee, and

iv) seepage berms to reduce the seepage exit gradient at the levee toe.

Refer to the following documents for detailed information regarding the geotechnical investigation and analysis performed for the WSLIP Project:

i) Draft Alternatives Analysis Report, West Sacramento Levee Improvement Program, (HDR, November 2009)

ii) Phase 1 Geotechnical Evaluation Report (p1GER) West Sacramento Region (State of California Department of Water Resources, URS, November 2007)

iii) Draft Problem Identification Report Reaches 1 and 3 (HDR, June 2007)

12.2 Hydraulics and Hydrology Analysis

The WSLIP focuses on improvements to the perimeter levee system around the City of West Sacramento. The proposed improvements to the perimeter levee system are not being pursued in isolation or in a manner that would prejudice flood risk reduction efforts elsewhere in the region. Rather, the WSLIP EIP improvements are an integral part of an evolving regional approach to flood risk reduction in the Lower Sacramento Valley being carried out in cooperation with the Bureau of Reclamation, the State of California, the Counties of Sacramento, Sutter, and Yolo, and local reclamation districts and land conservation organizations. This regional program incorporates a blend of structural and non-structural measures that is designed to reduce or mitigate the risk of flooding to property and public safety in the agricultural and urban basins surrounding the City of West Sacramento.

12.3 Risk and Uncertainty Analysis

A risk and uncertainty analysis has not been performed for the West Sacramento Levee Improvement Program, as it is unclear if the USACE will require and R&U analysis for projects at The Rivers and CHP Academy projects. While the WSLIP does include some levee raising the projects that are seeking approval under this 408 request at Rivers and CHP Academy projects do not include levee raising. WSAFCA will continue to coordinate with the USACE on this issue and it is not yet clear if an R&U analysis will be required to support the 408.

12.4 Levee Vegetation Management

The levee improvements being pursued at the Rivers and CHP Academy will be fully complaint with the current USACE vegetation ETL.

12.5 Real Estate Analysis

The Rivers and the CHP Academy Projects involves real property interests required for its construction and subsequent operation and maintenance. WSAFCA will acquire fee title to the areas required for the levee improvement facilities. Temporary construction easements will be acquired for the areas required for haul routes and working areas. Permanent easements will be acquired as needed for road and access modifications, and for drainage outlet facilities. As of June 2010, no property rights required for the CHP Academy of the Rivers Projects have been acquired in fee, permanent easement or temporary construction easement.

OR

12.5.1 The CHP Academy

The CHP Academy is adjacent to State owned facilities. WSAFCA is working with the USACE, DWR, local utility providers, and the State agencies adjacent to the CHP Academy site to minimize the need to acquire real estate to support the CHP Academy project. The project will require the relocation of adjacent utilities. **Plate 3** shows the exiting property limits and the acquisition take lines for the CHP Academy. Table 1 shows a list of the properties that may require some form of real estate action or relocation for the CHP Academy Project.

Table 1: CHP Academy Properties Affected by Flood Control Improvements, Fees and Easements

APN	Owner's Name	Owner's Mailing Address	City/State	Zip
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014-600-033	State of California	DGS, 707 3rd Street	West Sacramento, CA	95605
014-600-065	State of California	DGS, 707 3rd Street	West Sacramento, CA	95605

12.5.2 The Rivers

Several parcels have been identified as potentially being impacted by construction of the Rivers project. The project specific improvements covered in the EIS/EIR extend further the the currently contemplated construction extent for the Rivers Project. **Plate 4** shows the exiting property limits and the acquisition take lines for The Rivers Project. Table 2 shows a list of the properties that may require some form of real estate action or relocation for The Rivers Project.

Table 2: The Rivers Properties Affected by Flood Control Improvements, Fees and Easements

APN	Owner's Name	Owner's Mailing Address	City/State	Zip
014-580-009	WILLIAMS PORTFOLIO 2	3190 CLEARVIEW WAY #200	SAN MATEO, CA	94402
014-580-010	WILLIAMS PORTFOLIO 2	3190 CLEARVIEW WAY #200	SAN MATEO, CA	94402
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014-720-002	RIVERS COMMUNITY ASSN INC THE	101 PARKSHORE DR #100	FOLSOM, CA	95630
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014-720-065	DUNBAR HARVEY & LARA DIAZ	4660 NATOMAS BLVD, #120-58	SACRAMENTO, CA	95835
014-760-001	STATE OF CALIFORNIA	(Not available)	SACRAMENTO, CA	95814
014-760-002	STATE OF CALIFORNIA	(Not available)	SACRAMENTO, CA	95814

12.5.3 Relocation Assistance Program

WSAFCA will comply with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 916456 for eligible owners and/or tenants. A comprehensive Relocation Plan has been developed to address the needs of displaced owners and tenants of the Natomas Levee Improvement Project. As the various phases of the project progresses, the Relocation Plan will be augmented with the specific information about each displacee. Services performed to complete the Relocation Plan and Assistance Program includes:

1) Interview potentially affected occupants to determine relocation needs. The interview queries business needs, special licensing or zoning needs, needed permits, information on trade areas, special moving requirements, etc. The interview also queries household information such as: the number, ages and gender of all occupants, income of the household, distance to employment and utilized neighborhood services, special needs of the household, etc.

2) Research the marketplace for available replacement locations and/or establish rent schedules for compiling project costs.

3) Compile statistics on available housing and business replacement sites.

4) Calculate potential project costs.

5) Distribute plan to project participants and make it available for public inspection.

6) Make any needed revisions brought up during the public inspection.

7) Secure basic case information and set up case file; maintain the necessary case documentation and contact diary throughout the course of our involvement with the displace.

8) Conduct initial in-depth field interview with claimant: Document rent, income, family size, names/ages of occupants and determines relocation needs, preferences and special requirements; provide general information notices and brochure; explain relocation process, rights and benefits available.

9) Provide on-going advisory assistance to minimize hardships on claimants, including referrals to and coordination with community service resources, public housing and other public services as needed.

10) Document rent with rental agreement, receipts, or economic rent if needed.

11) Document/verify income using pay stubs, budget worksheets, tax returns, certification, and/or cash affidavit as necessary. Use rent-to-rent method if income cannot be verified.

12) Create rent schedule for project as appropriate.

13) Search for and document comparables for each displacee: provide initial referrals and three sets of additional housing referrals every 4-6 weeks, as necessary; search for available non-residential sites; recommend at least one appropriate site or determine that no such site exists. Provide with any referral, an evaluation form which requests feedback as to the suitability of the site referral.

14) Prepare letter of eligibility based on most appropriate comparable or rent schedule.

15) Deliver letter of eligibility to displacee, discuss findings and impacts to occupants' particular needs. Amend the letter of eligibility one additional time if the economics of the comparable's availability changes.

16) Prepare and deliver 90-day notices to vacate no later than 12 weeks after general information notices have been delivered.

17) Arrange for transportation to view replacement sites if needed; assist claimants with their selection of a replacement site, with lease offers, with review of rental agreements, and with move bids or fixed moving payment.

18) Inspect selected site to ensure it meets decent, safe, and sanitary requirements.

19) Review and discuss displacee's moving plans, build-out specifications and personal property inventory and coordinate eligibility limitations in advance of physical move.

20) Verify vacation of the displacement site and secure a certificate of abandonment.

21) Determine eligibility for proposed amount of relocation benefits, including actual and reasonable moving payments, rental/purchase differential payments, re-establishment payments, and fixed payments as applicable.

22) For residential moves, secure and process an advance claim to assist with the move, and a second final claim incorporating the moving costs and rental/purchase differential payment once family has moved to selected displacement site. For non-residential moves, secure and process moving assistance, re-establishment, in-lieu, or settlement claims ensuring that no item was duplicated in the acquisition process.

23) Each claim will be signed by the displacee, and supported by appropriate back-up information including written bids, schedules, receipts, etc.

13 Administrative Record

WSAFCA and its consultants are continuing to compile an Administrative Record as required by NEPA and CEQA. The Administrative Record includes everything the agency has considered in reaching a Federal decision regarding this proposed action. Significant contributions to this effort are listed in the WSLIP Draft EIS/EIR. Further information can be obtained upon request.

14 Technical Support Documents

1) CHP Academy 90% Design Documentation Report (HDR, March 2010)
2) The Rivers 90% Design Documentation Report (HDR, March 2010)
3) Draft Alternatives Analysis Report, West Sacramento Levee Improvement Program, (HDR, November 2009)
4) Phase 1 Geotechnical Evaluation Report (p1GER) West Sacramento Region (State of California Department of Water Resources, URS, November 2007)
5) Draft Problem Identification Report Reaches 1 and 3 (HDR, June 2007)

PLATE 1: WSLIP Construction Phasing Map

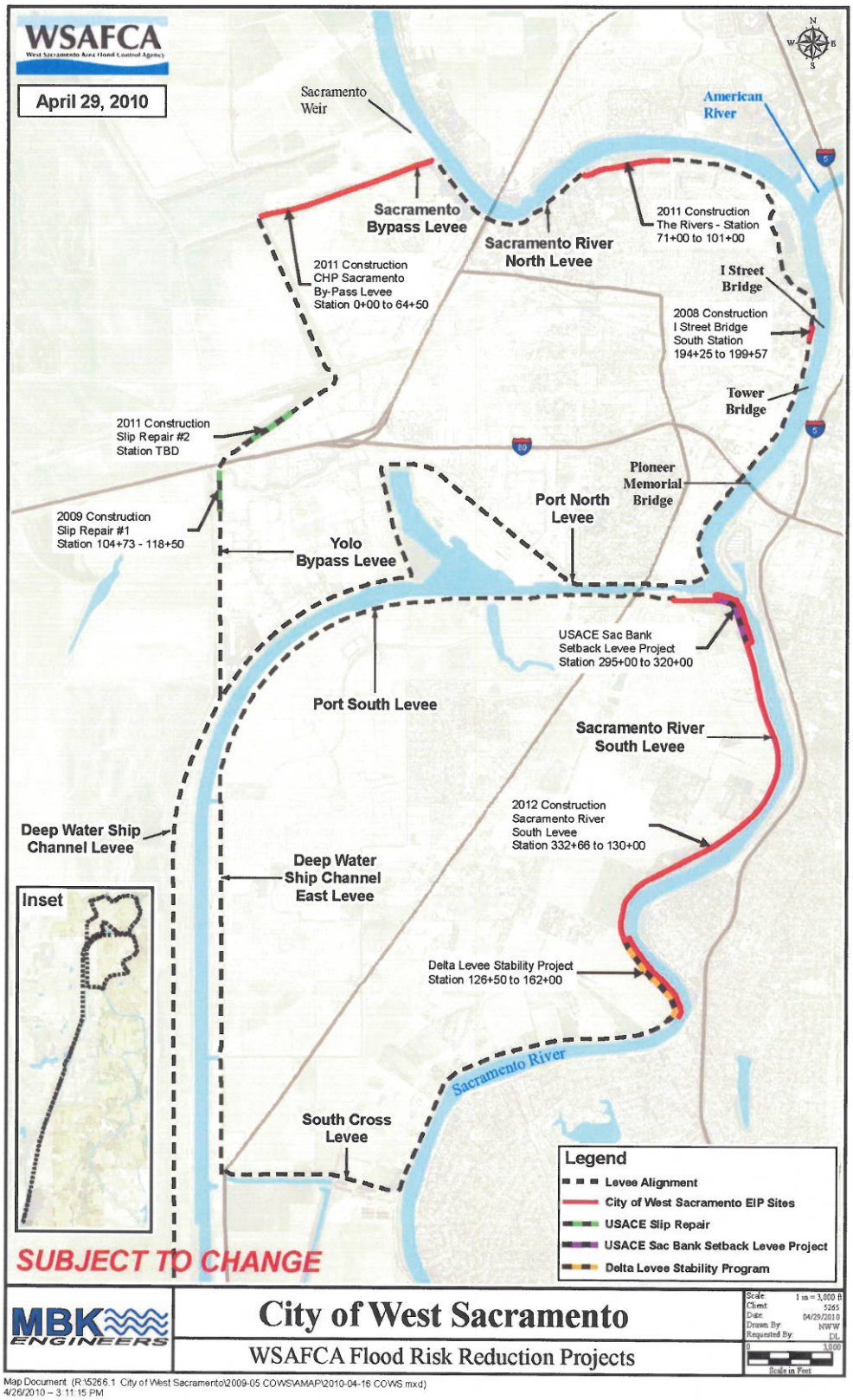


PLATE 2: Typical Levee Section with Cutoff Wall

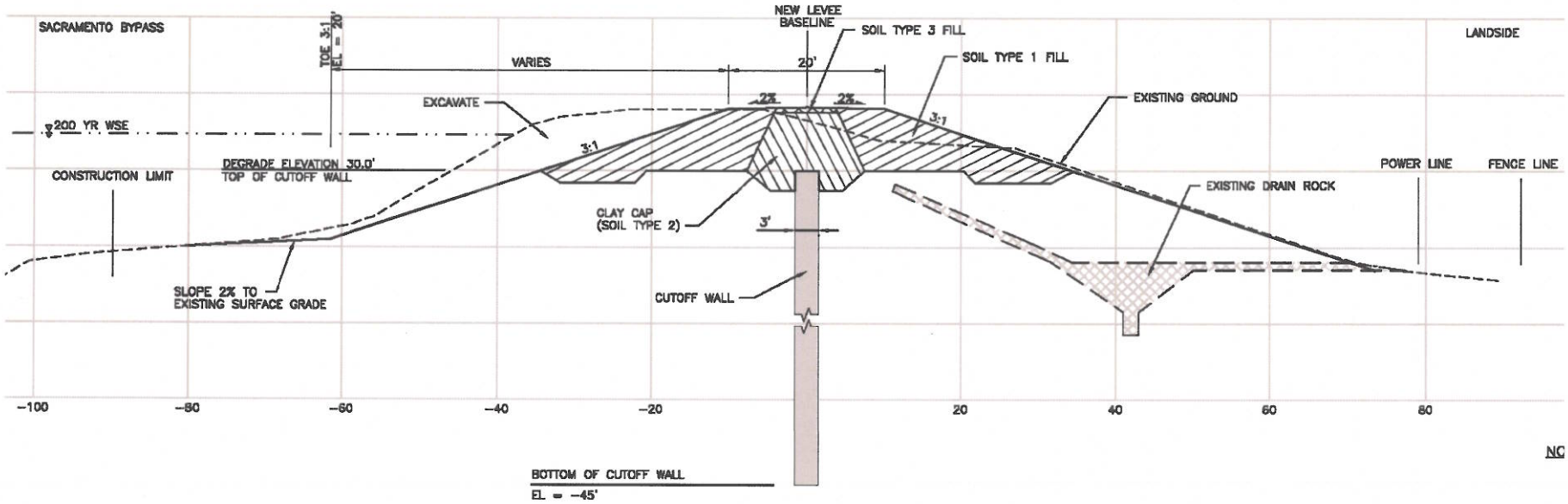


PLATE 3: Real Estate Impact on Sacramento Bypass South Levee at CHP Academy

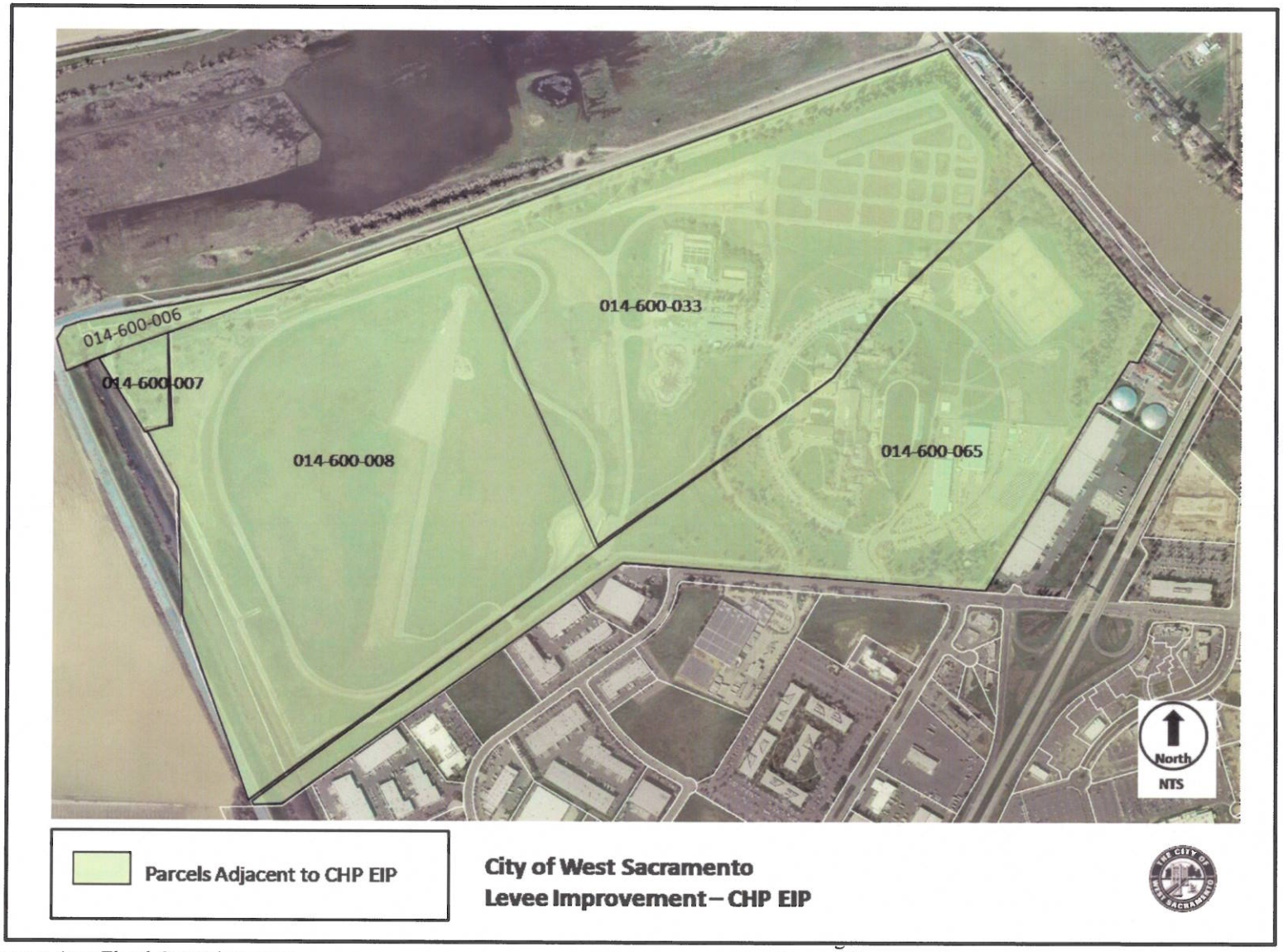
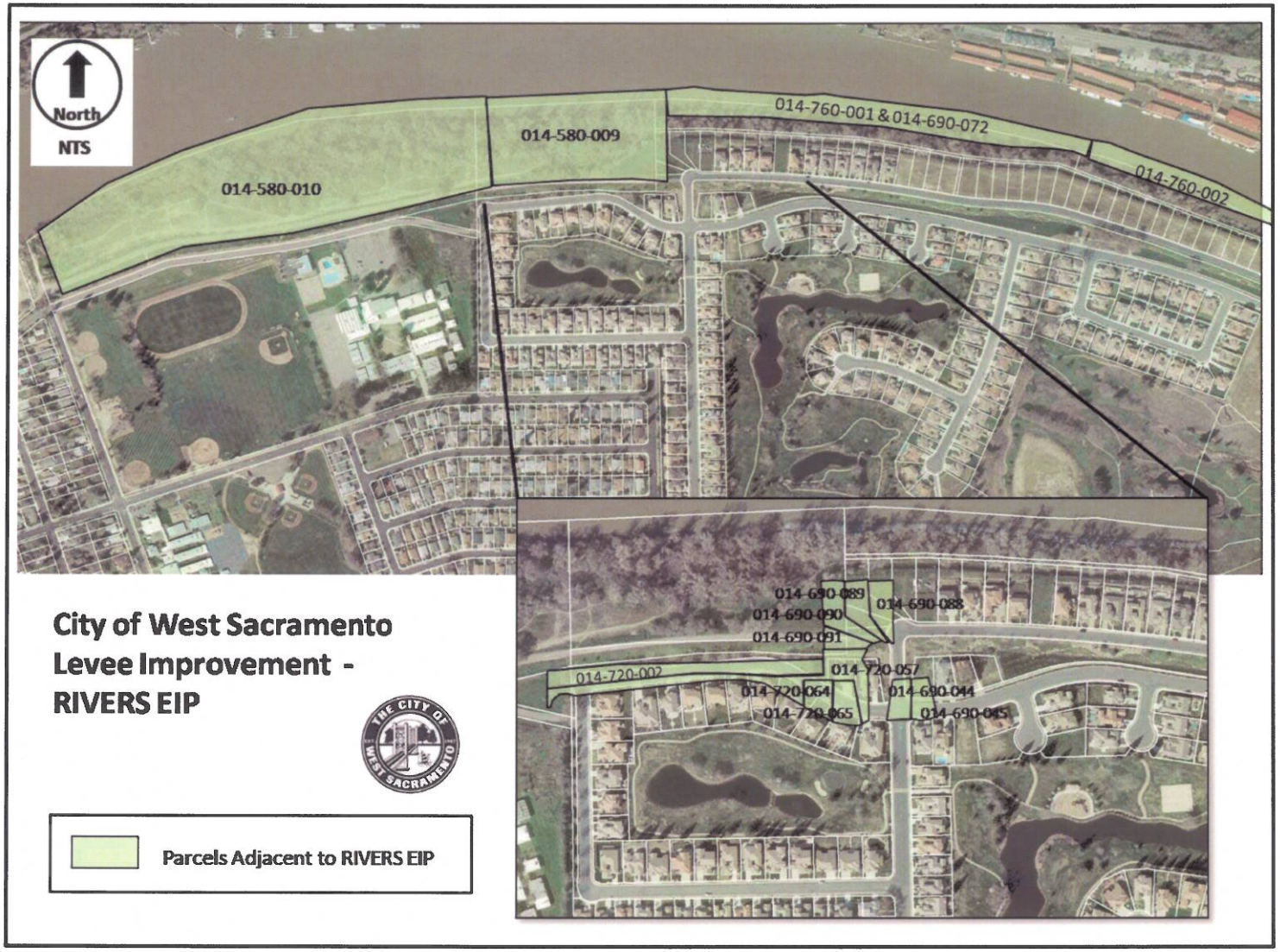


PLATE 4: Real Estate Impact on Sacramento River West Levee at The Rivers



dredged solids were placed between the shoreline and the original levee producing an over widened levee – approximately 150-300 ft wide - with a strip of thick riparian vegetation along the shoreline.

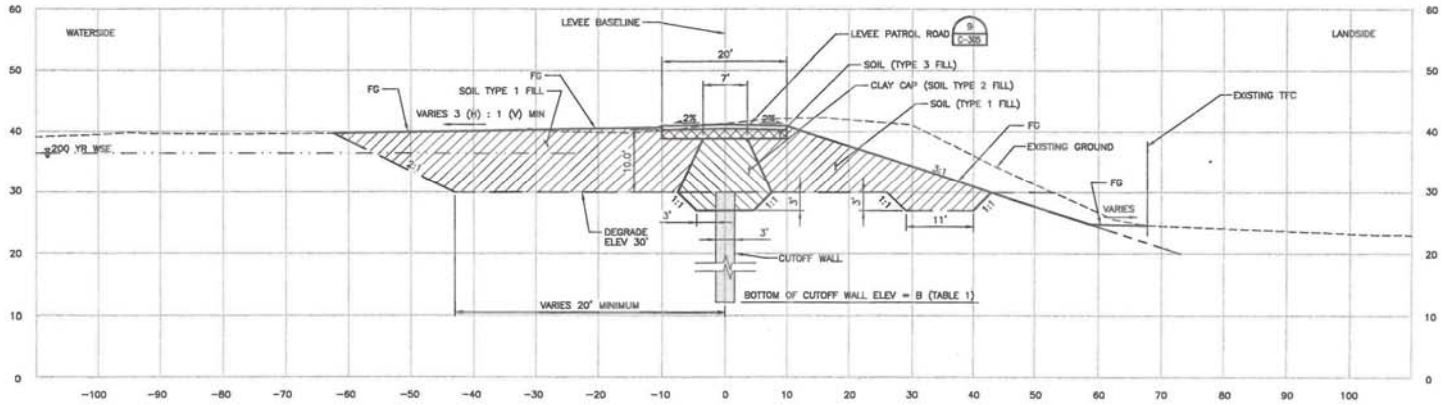
2.0 Purpose

The purpose of this report is to provide documentation of the design process and criteria applied to prepare construction plans, specifications and estimates (PS&E) for the upgrade of the project levee (Figure 2-1) as per Alternative 1 in the West Sacramento Levee Improvement Alternative Analysis, November 2009. The proposed improvements are to provide protection against a 200-year flood event (0.5% probability of occurring during any given year) consistent with the goals of the City of West Sacramento. Proposed improvements include installation of a deep cutoff and slope flattening throughout the project extents. A number of site civil features are proposed as well, such as a levee access ramp for operation and maintenance purposes, recreation trails, interpretive signage and a river outlook, and a pedestrian, ADA-compliant ramp to provide access to the recreation features. **Table 2-1** in the following section provides a project syllabus containing major design features and associated metrics.

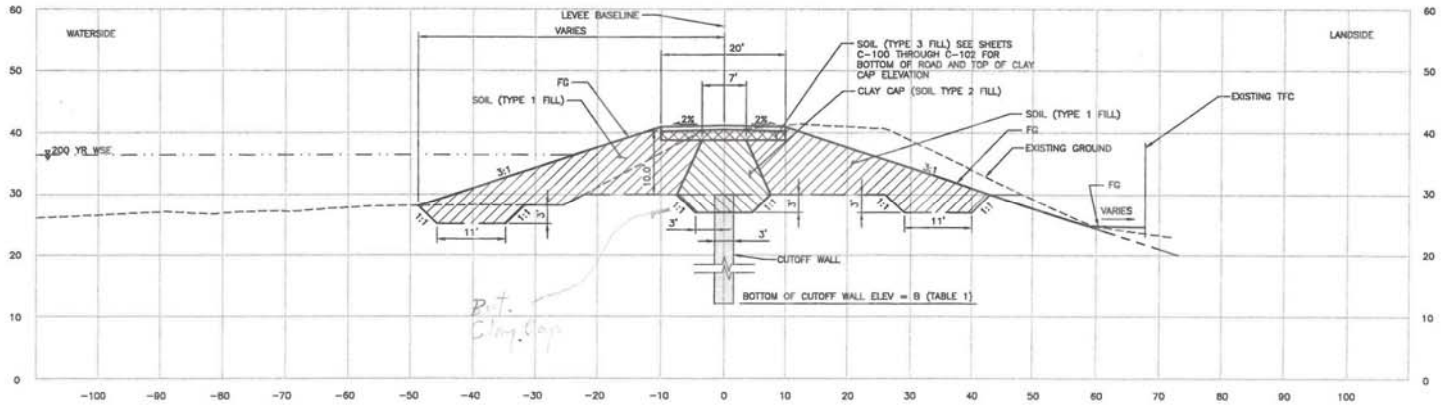
Table 2-1
THE RIVERS EIP PROJECT SYLLABUS

Design Feature	Value(s)	Comment
Levee Crest Elevation[1]	40.0 – 44.0 ft.	200-yr WSEL + 3 ft, unless existing levee is higher, in which case existing will be matched
Levee Side Slopes		
Waterside	3(H) : 1(V) Min.	Imbedded in high ground due to over-widened levee section
Landside	3(H) : 1(V)	
Levee Earthwork		
Levee Degrade	147,100 CY (in-place)	Contractor may reuse suitable material
Levee Re-build	99,600 CY (in-place)	
Slope Treatment	Hydroseed	
Upgrade Length	3000 ft.	
Cutoff Wall Depth	125 ft.	Sta 71+00 – Sta 87+25
	100 ft.	Sta 87+25 – Sta 97+25
	90 ft.	Sta 97+25 – Sta 101+00
Levee Patrol Road (Asphalt)	3048 ft.	Sta 70+77 – Sta 101+25
Maintenance Road	260 ft.	Aggregate Base Surface
Access Ramp & Landing	196 ft.	Asphalt Surface
Recreational Features		
Pedestrian/ADA Access Ramp & Single Vehicle Parking Space	306 ft.	Asphalt Surface
Pedestrian Foot Trail	3940 ft.	Asphalt Surface

[1] All elevations reference the NAVD 88 vertical datum.



TYPICAL LEVEE UPGRADE – DETAIL 1
76+75 TO 94+00



TYPICAL LEVEE UPGRADE – DETAIL 2
95+00 TO 98+00

TABLE 1

REACH	STATION RANGE	ELEV B
1	70+00 – 87+50	-95'
2	87+50 – 97+50	-70'
3	97+50 – 101+24	-60'

HORIZONTAL DATUM IS THE CALIFORNIA COORDINATE SYSTEM, ZONE 2 (NAD 83)

VERTICAL DATUM IS

HDR Engineering, Inc.

Project Manager: E. NAGY
Designed: M. VECCHIO
Drawn:
Checked:

City of West Sacramento
Levee Improvement Program
Early Implementation Project
The Rivers Site

WEST SACRAMENTO EIP - THE RIVERS SITE

TYPICAL LEVEE SECTIONS AND SECTION SCHEDULE

Date: FEBRUARY 2010
Project No.: 007436-101209-141

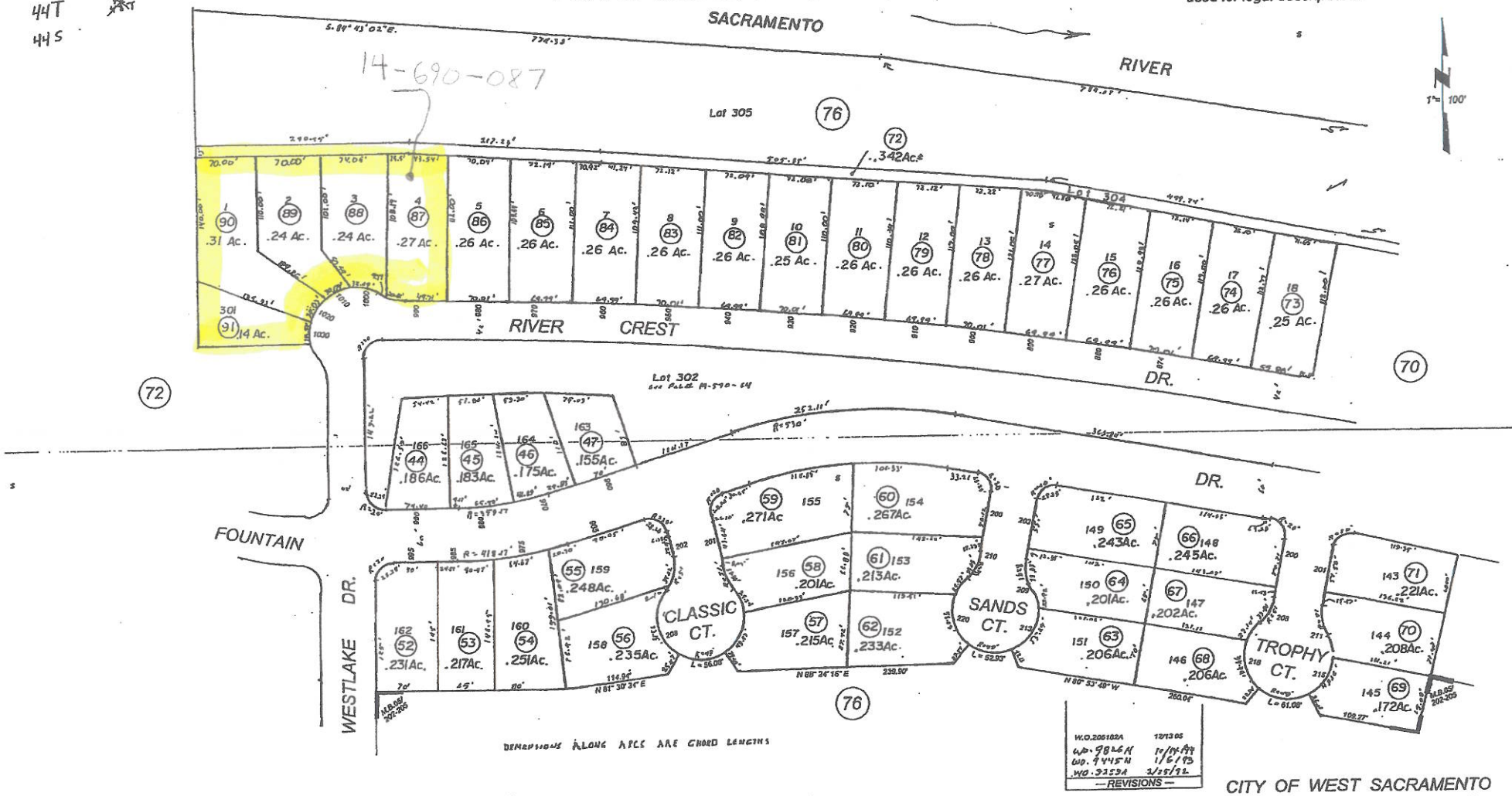
ATTACHMENT E - Typical Sections

44T
44S

POR. OF SEC. 27, T. 9N., R. 4E., M.D.B. & M.

CAUTION - These Maps ARE NOT to be used for legal descriptions.

14 - 69



M.B. 17, Pg. 1 - 18 - Lighthouse Marina - Unit No. A, Subd. # 3953

CITY OF WEST SACRAMENTO
Assessor's Map Bk. 14, Pg. 69
County of Yolo, Calif.

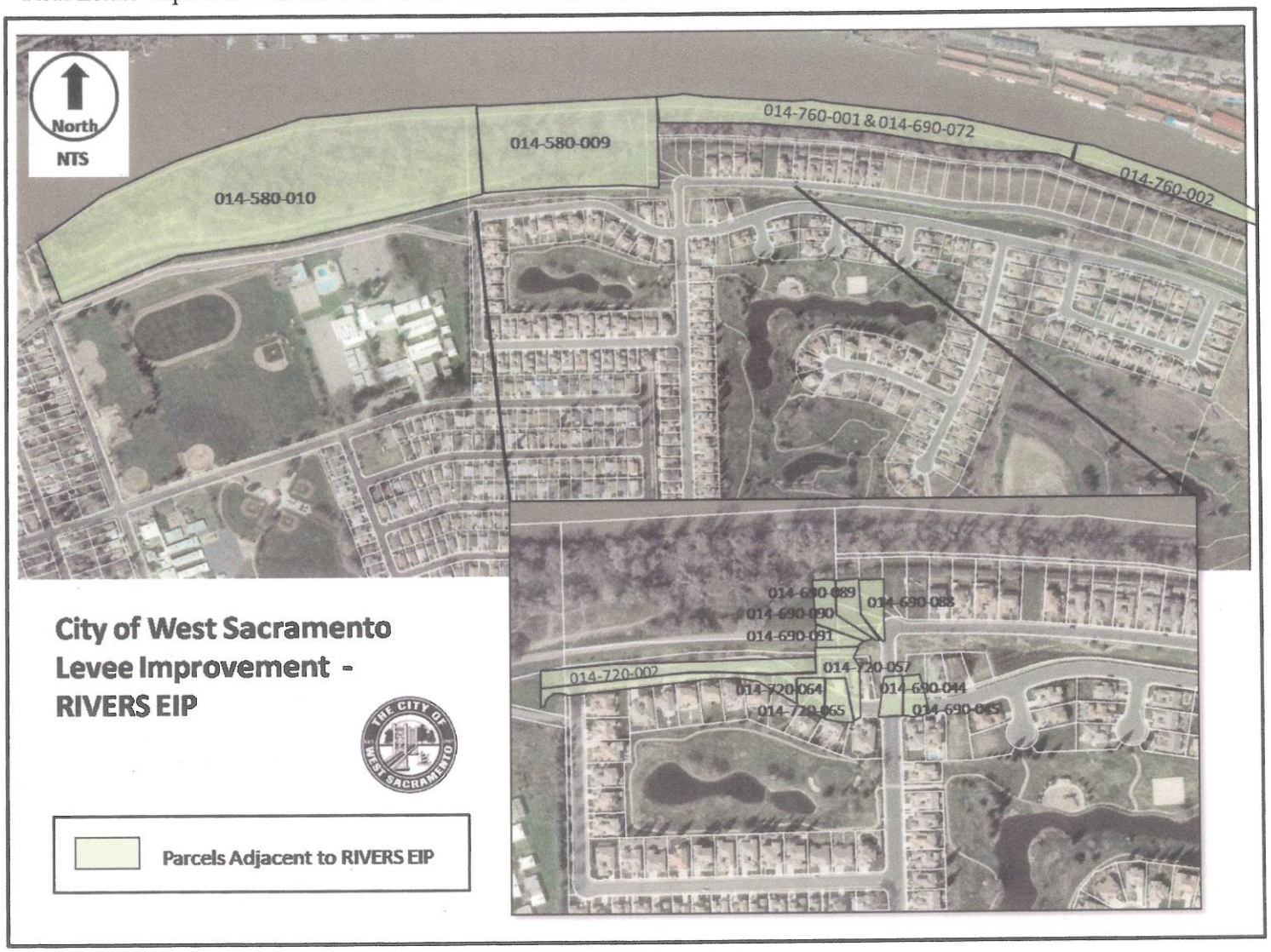
06/07

(formerly por. 14 - 58 & 59)

NOTE - Assessor's Block Number Shown in Ellipses.
Assessor's Parcel Number Shown in Circles.

ATTACHMENT F - Assesor's Parcel Map 14-69

PLATE 4: Real Estate Impact on Sacramento River West Levee at The Rivers



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12.5.2 The Rivers

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